EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERY

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I hereby declare that the thesis entitled **"EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERY"** submitted towards partial fulfillment of the requirements for the award of **MD IN ANAESTHESIOLOGY** degree to BFUHS is a compilation of original work carried out by me under the supervision of **Dr. Mirley Rupinder Singh,** Professor, Department of Anaesthesiology, **Dr. Neeru Luthra**, Professor, Department of Anaesthesiology & **Dr. Pankaj Mohindra,** Professor, Department of Orthopaedics. No part of this thesis has formed the basis for the award of any degree previously.

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Dedicated

to

my Family

&

Teachers

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LIST OF ABBREVIATIONS

ASIS	Anterior Superior Iliac Spine
ASA	American Society of Anaesthesiologists
ATP	Adenosine Triphosphate
CT	Computed Tomography
CNS	Central Nervous System
DH	Dorsal Horn (of spinal cord)
FICB	Fascia Iliaca Compartment Block
FIC	Fascia Iliaca Compartment
FN	Femoral Nerve
GA	General Anaesthesia
HR	Heart Rate
IV	Intra-Venous
LA	Local Anaesthetics
LFCN	Lateral Femoral Cutaneous Nerve
NO	Nitric Oxide
NRS	Numerical Rating Scale
NIBP	Non-Invasive Blood Pressure
NGF	Nerve Growth Factor
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
ORIF	Open Reduction and Internal Fixation
ON	Obturator Nerve
PG	Prostaglandin
PNS	Peripheral Nervous System
PNBs	Peripheral Nerve Blocks
PACU	Post Anaesthesia Care Unit
PONV	Post-Operative Nausea and Vomitting
PENG	Peri-Capsular Nerve Group (Block)
RCT	Randomized Controlled Trail

SAB	Sub-Arachanoid Block
SBP	Systolic Blood Pressure
SD	Standard Deviation
THA	Total Hip Arthrotomy
THR	Total Hip Replacement
USG	Ultra-Sound Guided
VAS	Visual Analogue scale
5-HT	5-Hydroxytryptamine (receptors)

ABSTRACT

Introduction: Ultrasound guided (USG) Fascia Iliaca Compartment Block (FICB) is being used widely for post-operative analgesia in patients undergoing hip surgeries, arthroplasty and femur fracture fixation. We aim to compare different volumes of 0.2% ropivacaine in suprainguinal FICB for post-operative pain relief in lower limb surgeries.

Aims & Objectives: To compare efficacy of different volumes of 0.2% ropivacaine (i.e. 20 mL, 30 mL and 40 mL) in ultrasound guided suprainguinal approach to FICB for post-operative pain relief after lower limb surgeries.

Material & Methods: After approval from institutional ethics committee, 90 patients undergoing above knee lower limb orthopaedic surgeries were recruited and allocated randomly into groups A, B and C. All patients received spinal anaesthesia after which USG suprainguinal FICB was performed with group A receiving 20 mL 0.2% ropivacaine, group B receiving 30 mL 0.2% ropivacaine and group C receiving 40 mL 0.2% ropivacaine. Intravenous tramadol was used as rescue analgesia when Numerical Rating Scale (NRS) score was >/= 4. Time to first request of rescue analgesia in minutes was compared between the three groups. NRS scores in the first 24 hours post-operatively, total amount of tramadol consumption in 24 hours and patient satisfaction with pain management were compared between the three groups as secondary outcomes. Data this collected was statistically analysed.

Results: Time to first request to rescue analgesia was significantly longer in group B and group C as compared to group A. NRS scores were significantly reduced in group B and group C than group A in the 24 hour post-operative period. Mean 24 hour tramadol consumption was significantly less in group C as compared to group A and group B. Patient satisfaction with pain management was better with group B and group C as compared to group A.

Conclusion: 30 mL and 40 mL of 0.2% ropivacaine in suprainguinal FICB is efficacious in significantly reducing pain in post-operative period after hip and lower limb surgeries.

Keywords: Ultrasound guided, Fascia iliaca compartment block, NRS, Ropivacaine, Post-operative Analgesia

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INTRODUCTION

Adequate pain control is an important part of postoperative care and treatment. World Health Organization, as well as International Association for the Study of Pain, have emphasized its significance for patients' well-being, determining pain relief to be a human right and the occurrence of pain as "fifth vital sign". [1]

Femur and hip surgeries are known to be associated with moderate-to-severe postoperative pain for the first 24–48 hours, which may adversely affect early mobilization and physiotherapy, eventually affecting rehabilitation of the patient. This pain is primarily due to extensive bony and soft-tissue damage.

Postoperative pain management is usually via multimodal analgesia including both systemic and regional analgesia. Systemic analgesia includes oral, parenteral, or transdermal administration of opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), and paracetamol. Regional analgesia involves intra-articular injection of local anaesthetic (LA) or opioid, neuraxial analgesia, and peripheral nerve blocks.[2] Conventional analgesics used as a part of multimodal analgesia after lower limb surgeries, such as non-steroidal anti-inflammatory drugs and opioids, are associated with side effects like nausea, vomiting, drowsiness, urinary retention and constipation, cough suppression and respiratory depression. NSAIDs may affect renal function and cause gastrointestinal haemorrhage.

Peripheral nerve blocks such as femoral nerve (FN) block, Winnie's 3-in-1 FN block, pericapsular nerve group block and fascia iliaca compartment block (FICB) have been used to provide postoperative analgesia and have shown opioid-sparing effects.[3-5]

The fascia iliaca compartment block (FICB) is a regional anaesthesia technique where local anaesthetic is deposited in fascial plane below the fascia iliaca and above the iliacus muscle in the fascia iliaca region. The fascia iliaca compartment block (FICB) was first described by Dalens and colleagues in 1989.[6] Indications for a FICB include surgical anaesthesia to the lower extremity after knee, femoral shaft, hip surgery,

management of cancer pain or pain secondary to inflammatory conditions of the lumbar plexus, as well as treatment of acute pain in the setting of trauma, fracture, or burns. The FICB is commonly administered in children for anterolateral thigh surgery.[7]

The FICB may be performed using either a loss of resistance technique or an ultrasound (US)-guided technique. The main targets of the supra-inguinal FICB are the predominant nerves contained in the fascia iliaca compartment (FIC), namely the femoral nerve(FN) and the lateral femoral cutaneous nerve(LFCN).[8] This block is an anterior approach to the lumbar plexus, where local anaesthetic is injected proximally beneath the fascia iliaca, above the inguinal ligament with the aim of blocking the femoral nerve(FN), the lateral femoral cutaneous nerve of thigh(LFCN), and the obturator nerve(ON) at its origin at the level of lumbar plexus. The femoral and obturator nerves(ON) innervate the hip joint capsule, with the main nerve supply being from the obturator nerve.[9] The lateral cutaneous nerve of thigh confers cutaneous innervation to anterolateral thigh which is also anaesthetized, and obturator nerve, which is primarily motor, supplies the medial adductors of the thigh, and innervates a portion of skin over the medial thigh. Thus anaesthetizing the anterior and medial thigh, including the knee joint, and also the articular fibres of the hip and knee. Blockade of the femoral nerve also provides sensory anaesthesia of the anterior thigh, knee, medial aspect of the calf, ankle, and foot.[10]

Fascia Iliaca Compartment Block (FICB) has been widely used as a postoperative analgesic adjunct to opioids for lower limb surgeries, either by the conventional infra-inguinal approach or the modified proximal supra-inguinal approach. The fascia iliaca compartment is a potential space lying between the fascia ilaca anteriorly and the iliacus and psoas muscles (iliopsoas) posteriorly. The FN arises from the second to fourth lumbar nerve roots and descends through the fibres of psoas major before passing distally between the psoas and iliacus muscles. The LFCN is a purely sensory nerve which arises from the second and third lumbar nerve roots and passes deep to the fascia iliaca before leaving the fascial plane around the level of the inguinal ligament.

The ON arises from the second to fourth lumbar roots, is predominantly a motor nerve, and inconsistently innervates a proportion of the skin of the medial thigh. All of these nerves lie within the fascia iliaca compartment at the proximal end of their anatomical course, and therefore placement of LA beneath the fascia iliaca should, in theory, result in anaesthesia of FN, ON, and LFCN. The modified suprainguinal approach (suggested by Stevens[11]) involves placing the block 1 cm above the inguinal ligament as opposed to 0.5 cm below the inguinal ligament in the conventional infrainguinal approach.

The modified FICB advised by Stevens[11] has more proximal spread of local anaesthetics, which is further confirmed in a cadaveric study. In their study, Kumar et al observed that in total hip arthrotomy (THA) modified supra-inguinal FICB has significantly greater opioid sparing effect (i.e. requires less morphine consumption) as compared to the conventional infra-inguinal FICB at 6, 12 and 24 hours for optimal analgesia in the postoperative period. The pain intensity as measured by VAS scores was significantly lower in supra-inguinal FICB at 6 hours post- operatively as compared to infra-inguinal FICB.[12]

Our study is on the supra-inguinal approach to FICB as preliminary studies showed that nerve block with fascia iliaca compartment block (FICB) could significantly relieve the pain due to hip fracture in elderly patients who were expected to undergo surgery within 48 hours after hospital admission. Also, the FICB procedure has been shown to improve the quality of life during hospitalization, and better pain relief, thus resulting in a reduced requirement for analgesic drugs.[13] Preoperative fascia iliaca compartment block significantly decreases postoperative opioid consumption while improving patient satisfaction.[14]

Different volumes of local anaesthetics infiltrated in the fascia iliaca compartment have been studied. A volume of 20 ml was sufficient to spread to both the femoral nerve and lateral cutaneous nerve of the thigh in ultrasound-guided supra-inguinal FICB in a cadaver study.[15] However, relatively high amounts (30–40 ml) of local anaesthetic solution have been used in the clinical reports of supra-inguinal

FICB[11,12,16] The use of the smallest possible volume of local anaesthetics to block the major nerves would improve the safety of nerve blocks. In our study, we used 20 ml, 30 ml and 40 ml of 0.2% ropivacaine in the suprainguinal FICB, to find minimum efficacious volume of the drug for effective post-operative pain relief.

Various local anaesthetics such as 0.5% levobupivacaine, 0.25% bupivacaine, 0.5% bupivacaine, 1% mepivacaine, 1% lidocaine with epinephrine, 0.4% ropivacaine and 0.2% ropivacaine have been used in a fascia iliaca compartment block. These local anaesthetics have also been used along with adjuncts such as dexamethasone, magnesium sulphate and clonidine to improve efficacy of the block.

Ropivacaine is a long-acting amide local anesthetic, being less lipophilic than bupivacaine resulting in less central nervous system toxicity and cardiotoxicity. In the concentration of 0.2%, ropivacaine is a safe and effective drug to be used in the fascia iliaca compartment block in adequate volumes.

Studies so far have not compared different volumes of local anaesthetic in ultrasound guided supra-inguinal fascia iliaca compartment block as part of multimodal analgesia after lower limb surgeries. In our study, we propose to use different volumes of local anaesthetic (0.2% ropivacaine), such as 20 ml, 30 ml, and 40 ml, to evaluate the volume which effectively spreads to the lumbar plexus to block the femoral nerve, the obturator nerve and the lateral femoral cutaneous nerve of thigh simultaneously, thus providing adequate analgesia for post-operative cases of lower limb surgeries.

AIMS AND OBJECTIVES

To compare the efficacy of different volumes of 0.2% ropivacaine in supra inguinal fascia iliaca compartment block for post operative pain relief in lower limb surgeries.

REVIEW OF LITERATURE

The International Association for the Study of Pain's widely used definition defines pain as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage".[17] Painful stimuli are detected by nociceptors, which are free nerve endings located in tissues and organs. They have high thresholds and, under normal circumstances, only respond to noxious stimuli. The sensation of pain is associated with the activation of the receptors in the primary afferent fibers, which is inclusive of the unmyelinated C-fiber and myelinated Aσ-fiber. Both nociceptors remain silent during homeostasis in the absence of pain and are activated when there is a potential of noxious stimulus. The perception of a series of sensory events is required for the brain in order to detect pain and produce a response towards the threat. There are generally three main stages in the perception of pain. The first stage is pain sensitivity, followed by the second stage where the signals are transmitted from the periphery to the dorsal horn (DH), which is located in the spinal cord via the peripheral nervous system (PNS). Lastly, the third stage is to perform the transmission of the signals to the higher brain via the central nervous system (CNS). Typically, there are two routes for signal transmissions to be conducted: ascending and descending pathways. The pathway that goes upward carrying sensory information from the body via the spinal cord towards the brain is defined as the ascending pathway, whereas the nerves that goes downward from the brain to the reflex organs via the spinal cord is known as the descending pathway.

Pain can be classified into two types: chronic and acute pain. Acute inflammatory pain is normally intense and occurs for a short period of time, which is initiated as a response to harmful stimuli that are normally mediated by the Aδ-fibers. Leukocytes and plasma from the bloodstream are accumulated at the site of the injury to assist in the inflammatory process. However, prolonged inflammation, better known as chronic inflammatory pain, lasts beyond the expected period of healing, which is

typically mediated by C-fibers. There is a progressive shift of mononuclear cells at the site of the inflammation as well. Inflammatory pain causes the increase of afferent input into the DH of the spinal cord and leads to the development of central sensitization. There are some mediators produced at the site of injured tissue, which include 5-HT, kinins, histamine, nerve growth factors (NGF), adenosine triphosphate (ATP), PG, glutamate, leukotrienes, nitric oxide (NO), NE and protons. During the process of inflammation, these chemical inflammatory mediators are produced from the necrotic tissues, and interact to activate the nociceptors within the inflamed area.

Experience of pain has been reported as a common problem in clinical practice. Marks and Sachar[18] observed that 73% of medical in- patients had unrelieved pain of moderate to severe intensity despite treatment with opioids. Total hip replacements (THRs) are quite common these days and are quite successful surgery for many end-stage hip diseases in terms of pain relief and functional recovery.[19,20] Hip fracture surgery is one of the most commonly performed surgical procedures in older patients. In 2000, there were approximately 1.6 million hip fracture surgeries worldwide, and that number is expected to be 6.3 million by the year 2050[21]

However, THR are associated with severe perioperative pain which prolongs length of hospitalization and increases the morbidity and medical cost.[22,23] Though many guidelines reported that early surgery can relieve pain, and reduce the incidence of postoperative complications and mortality. Perioperative pain management is a big challenge for both patients and orthopaedician. Adequate pain management is crucial for improving the satisfaction of patients and clinical outcomes. Numerous strategies have been implemented to reduce postoperative pain following THR including local infiltration analgesia, epidural analgesia, intravenous non-steroidal anti-inflammatory agents and peripheral nerve block.[24-26]

The lumbar plexus is an essential collection of nerves that arise from mostly the lumbar spinal cord. The term plexus refers to a “web” of nerves that is created just lateral to where T12-L5 exit the spinal cord via

intervertebral foramina. The plexus exists bilaterally and allows nerves to combine with different levels to create multiple functioning nerves that serve to innervate various structures. This type of nerve web is significant for the formation of larger, longer nerves that target peripheral tissues that altogether primarily help to innervate the portions of lower extremities. The primary functions of these nerves are motor innervation and sensory nerves to the skin mainly in the lower extremities, although the superior nerves in the plexus do contribute to the lower abdomen and pelvis. The nerves arising from the lumbar plexus are vital for the functioning of the lower extremity and maintaining the ability to extend the knee, flex the hip, adduct the thigh, and more. The lateral femoral cutaneous nerve comes from the L2 and L3 spinal nerves. It serves the singular function of supplying sensory innervation to much of the lateral portion of the thigh.

The femoral nerve ranks as the largest nerve that arises from the lumbar plexus. It is created from lumbar spinal nerves L2, L3, and L4. Its principal function is to supply motor and sensory innervation to the anterior compartment of the thigh. The nerve exits the plexus and enters the femoral triangle, passing just lateral to the femoral artery. The nerve has four major branches: muscular (motor), cutaneous, articular, and vascular. The motor branch supplies the muscles quadriceps femoris, sartorius, and articularis genu. The cutaneous branch is the primary sensory supply to the anterior thigh. A portion of the cutaneous branch become the saphenous nerve, which provides sensation the skin overlying the patella, and portions of the medial and anterior aspects of the distal lower extremity. The articular branch plays an essential role in the proprioceptive sensation of the knee. The vascular branch supplies the femoral artery and its smaller branches.

The obturator nerve arises from L2, L3, and L4 spinal nerves. It provides the primary motor supply to the medial (adductor) muscle compartment of the thigh. These muscles include external obturator, adductor longus, adductor brevis, adductor magnus, gracilis, and pectineus. It also has a sensory component that supplies the medial thigh that is inferior to the area supplied by the ilioinguinal nerve.

The fascia iliaca compartment block has been promoted as a valuable regional anaesthesia and analgesia technique for lower limb surgery. Numerous studies have been performed, but the evidence on the true benefits of the fascia iliaca compartment block is still limited. Recent anatomical, radiological, and clinical research has demonstrated the limitations of the landmark infra-inguinal technique. With the introduction of ultrasound, a new supra-inguinal approach of the fascia iliaca has been described. Research has demonstrated that this technique leads to a more reliable block of the target nerves than the infra-inguinal techniques.

The fascia iliaca compartment is a potential space lying between the fascia ilaca anteriorly and the iliacus and psoas muscles (iliopsoas) posteriorly. The fascia iliaca attaches to the iliac crest laterally and to the fascia overlying the psoas muscle medially. It lies posteriorly to the external iliac vessels and anteriorly to the nerves of the lumbar plexus. More distally, the fascia iliaca invests the FN and passes posterior to the femoral artery and vein which lie within the lacuna vasorum. The FN arises from the second to fourth lumbar nerve roots and descends through the fibres of psoas major before passing distally between the psoas and iliacus muscles. It then exits the pelvis to lie anterior to iliopsoas and lateral to the femoral vessels. The LFCN is a purely sensory nerve which arises from the second and third lumbar nerve roots and passes deep to the fascia iliaca before leaving the fascial plane around the level of the inguinal ligament. The ON arises from the second to fourth lumbar roots, is predominantly a motor nerve, and inconsistently innervates a proportion of the skin of the medial thigh. After penetrating the fascia and leaving the fascia iliaca compartment, the ON passes posterior to the common iliac artery before reaching the obturator foramen. All of these nerves lie within the fascia iliaca compartment at the proximal end of their anatomical course, and therefore placement of LA beneath the fascia iliaca should, in theory, result in anaesthesia of FN, ON, and LFCN. The genito-femoral nerve runs on the anterior aspect of the psoas muscle posterior to the fascia

iliaca and therefore, the FICB may also result in anaesthesia of the genito-femoral nerve.

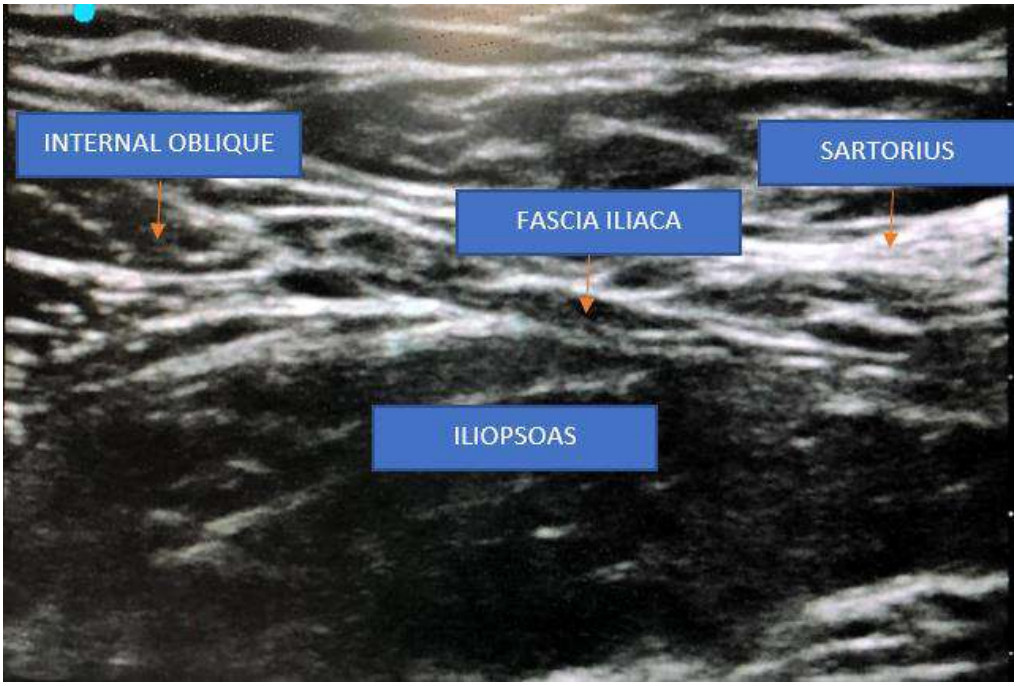


FIGURE 1: IMAGE SHOWING SONOANATOMY OF SUPRAINGUINAL FICB

The ultrasound-guided (USG) longitudinal supra-inguinal approach to the FICB was first described in a cadaver study by Hebbard in 2011.[15] On the 6 cadavers that they performed the study on, they noticed that there was extensive dye spread within the iliac fossa, and in 10 of the 12 injections dye also spread into the thigh along the femoral nerve, the superior to inferior spread [mean (SD)] measured 183 (36)mm and medial to lateral spread 75 (46)mm. The spread inferior to the inguinal ligament, along the course of the femoral nerve, was for a mean (SD) distance of 70 (46)mm. The dye also spread laterally to reach the anterior superior iliac spine in nine specimens and within 15mm of it in the other three specimens. Medially, the dye spread deep to the femoral artery to a distance of 3 (8mm) and a maximum of 25mm medial to the lateral wall of the femoral artery. In one specimen the dye stopped 8mm lateral to the femoral artery. There was no spread of dye superior to the iliac crest. They identified the femoral nerve bilaterally in all six cadavers and noted it was surrounded by dye in all cases.

The supra-inguinal approach to the FICB has also been described using a more proximal needle insertion point. A recent cadaveric study found that a volume of 40 ml was required to reliably block all three nerves using this approach.[27]

Ropivacaine, a long-acting amino amide local anaesthetic, is widely used in nerve blocks. Ropivacaine causes less cardiac toxicity and a higher safety margin compared with bupivacaine [28]

Studies showed that nerve blocks with 0.1% ropivacaine exerted a good analgesic action of sensory block without motor block [29-31]. Fascia iliac compartment block with 30 mL 0.1% ropivacaine has been reported to block all nerves in the fascia iliac compartment.

The USG longitudinal suprainguinal approach to the FICB theoretically improves block success rates as the LA is injected more cranially allowing more consistent block of the three targeted nerves (FN, LFCN, and ON). Success rates of ON blockade and blockade of all three nerves were 86% and 67%, respectively, in an RCT comparing USG suprainguinal FICB with placebo in patients undergoing total hip replacement (THR).[32] They conducted a prospective, double blind, randomized controlled trial. Patients scheduled for THA were randomized to group FICB (longitudinal supra-inguinal FICB with 40-mL ropivacaine 0.5%) or group C (control, no block). Standard hypothesis tests (t test or Mann-Whitney U test, χ test) were performed to analyse baseline characteristics and outcome parameters. The primary end point of the study was total morphine (mg) consumption at 24 hours postoperatively. Serial total and free ropivacaine serum levels were determined in 10 patients. 88 patients were included. Mean (SD) morphine consumption at 24 hours postoperatively was reduced in group FICB compared to group C: 10.25 (1.64) mg versus 19.0 (2.4) mg (P = 0.004). Using a mean dose of 2.6-mg/kg ropivacaine (range, 2-3.4 mg/kg), none of the patients had total or free ropivacaine levels above the maximum tolerated serum concentration. They concluded that a high-dose longitudinal supra-inguinal FICB reduces postoperative morphine requirements after anterior approach THA.

Indeed, a recent study demonstrated that the FN, LFCN, and ON could be reliably blocked using an USG suprainguinal FICB, but only if a volume of 40 ml was injected.[27] Patients included in the study included those above 18 years of age, of either sex weighing above 50 kg, ASA physical status I and II and operated for hip and femur surgeries. Postoperative pain assessment involved use of Numerical Rating scale (NRS); 0 = no pain, 10 = worst imaginable pain. Pain was assessed on arrival in post anaesthesia care unit (PACU) and thereafter at 6 hourly for 24 h. Injection paracetamol 1 g was administered intravenous (i.v.) 8 hourly as part of multimodal analgesia. NRS > 4 was treated as breakthrough pain and Injection Tramadol 100 mg was given as rescue analgesic. Patient satisfaction score with respect to postoperative analgesia was enquired after 24 h and was labelled as excellent, good, fair, and poor. Based on the combination of the type of anaesthesia administered and adjuvant used, study patients were divided into six groups: Group 1-SAB + FICB (0.25% bupivacaine). Group 2-SAB + FICB (0.25% bupivacaine + 1 µg. kg-1 of dexmedetomidine). Group 3-SAB + FICB (0.25% bupivacaine + 4 mg of dexamethasone). Group 4-GA + FICB (0.25% bupivacaine). Group 5-GA + FICB (0.25% bupivacaine + 1 µg. kg-1 of dexmedetomidine). Group 6-GA + FICB (0.25% bupivacaine + 4 mg of dexamethasone). Demographical variables (Age, Sex) and duration of anesthesia were comparable in all 6 groups and were insignificant ($P > 0.05$). Postoperative analgesia was comparable and insignificant ($P > 0.05$) at 0, 6, 12 h in all 6 groups. Postoperative analgesia was observed to be better with dexmedetomidine and dexamethasone as adjuvant (Groups 2, 3, 5, and 6) in comparison to plain bupivacaine (Groups1 and 4) at 18 h. Better postoperative analgesia was observed with dexmedetomidine as adjuvant (Groups 2 and 5) in comparison to dexamethasone as adjuvant (Group 3) and plain bupivacaine (Groups 1, 4) at 24 h. Need for rescue analgesia was observed to be maximum with plain bupivacaine (Groups 1, 4) compared with dexmedetomidine and dexamethasone as adjuvant (Groups 2, 3, 5, 6). Satisfaction levels were good and excellent in dexmedetomidine and dexamethasone as adjuvant, respectively

(Groups 2, 3, 5) in comparison to plain bupivacaine (Groups 1, 4). PONV was observed less in dexmedetomidine as adjuvant (Group 2, 5) in comparison to dexamethasone as adjuvant (Group 3) and plain bupivacaine (Groups1, 4). No adverse event was noted in postoperative period in the form of bradycardia, hypotension in any of the six groups. Addition of dexmedetomidine to bupivacaine provides longer duration and good quality postoperative analgesia and reduced requirement for rescue analgesic in comparison with bupivicaine alone in FICB-S in the postoperative period in hip and femur surgeries.

A study done by Kumie et al used 30 ml of 0.25% bupivacaine in patients weighing less than 80 kg and 40 ml of the same in patients weighing more than 80 kg to check the efficacy of FICB as a part of multimodal analgesia after surgery of femoral bone fracture and concluded that a single injection of FICNB could lead to post operative pain relief, reduction of total analgesic consumption and prolonged time for first analgesic request in the FICNB group after surgery for femoral bone fracture.[33] This is an institution-based case control study was conducted from September, 2013 to May, 2014. All patients who had been operated on under spinal anaesthesia for femoral bone fracture were included. The patients divided into a FICNB group (n=20) and a control group (n=20). The FICNB group was given 30 mL of 0.25% bupivacaine at the end of the operation. Postoperative pain was assessed within the first 24 hours, i.e. at 15 minutes, 2 hours, 6 hours, 12 hours and 24 hours using 100 mm visual analogue scale (VAS), total analgesic consumption, and the time for the first analgesic request. VAS pain scores were reduced within the first 24 hours after operation in the FICNB group compared with the control group. VAS scores at 2 hours were taken as median values (IQR) 0.00 (0.00) vs.18.00 (30.00), P=0.001; at 6 hours 0.00 (0.00) vs. 34.00 (20.75), P=0.000; at 24 hours 12.50 (10.00) vs. 31.50 (20.75), P=0.004; and at 12 hours (17.80±12.45) vs. (29.95±12.40), P=0.004, respectively. The total analgesic consumption of diclofenac at 12 and 24 hours was reduced in the FICNB group, and the time for the first analgesic request was significantly prolonged (417.50 vs. 139.25 minutes, P=0.000). they concluded that a single injection for FICNB

could lead to postoperative pain relief, reduction of total analgesic consumption and prolonged time for the first analgesic request in the FICNB group after surgery for femoral bone fracture. They recommend FICNB for analgesia after surgery for femoral bone fracture and for patients with femoral bone fracture at the emergency department.

Another study done by Kumar et al used 30 ml of 0.5% ropivacaine by 23G spinal needle to study the analgesic efficacy of ultrasound guided FICB in patients with hip fracture, and concluded that ultrasound-guided FICB can be performed safely without complications in controlling pain for patients with hip fractures, and performing an FICB before positioning for spinal anaesthesia provided good pain management and facilitates spinal performance wit wide patient acceptance, hence improving overall quality and efficiency of care.[34] This was a prospective study was conducted in 50 patients aged between 40-80 years, belonging to American Society of Anesthesiologists (ASA) physical status I-III undergoing surgery for hip fracture. All 50 patients received an ultrasound guided Fascia Iliaca Compartment Block (FICB) in the premedication room with 30 mL of 0.5% ropivacaine by 23G spinal needle. Sensory blockade was evaluated 5, 10 and 20 minutes after ropivacaine administration using loss of perception to cold in the lateral, anterior and medial part of the thigh. Visual analogue scale scores were noted before the block, 20 minutes after block and during positioning for spinal anaesthesia. Patient's acceptance for FICB was evaluated 24 hour after arriving back to the orthopaedics ward using a two-point score. In lateral part of thigh, at 5 minutes sensory blockade was present in 33 patients (66%) and at 10 minutes sensory blockade was present in 45 cases (90%). In anterior part of thigh, sensory blockade was present in 34 cases (68%) at 5 minutes time interval and at 10 minutes sensory blockade was present in 48 cases (96%). In medial part of thigh, 28 cases (56%) had sensory blockade at 5 minutes and at 10 minutes in 43 cases (86%). Sensory blockage was same at 20 minutes as on 10 minutes interval in all thigh parts. Before FIC block average VAS was 7.5 which was decreased to average of 2.94 at 20 minutes after block which was statistically signi cant ($p<0.01$). During positioning for spinal

anaesthesia, 46 patients had VAS less than 4. Positioning during spinal anaesthesia was assessed unsatisfactory (0) in 2 cases (4%), satisfactory (1) in 5 cases (10%), good (2) in 25 cases (50%) and excellent (3) in 18 cases (36%). They concluded that an ultrasound guided FICB can be performed safely without complications in controlling pain for patients with hip fracture. Performing an FICB before positioning for spinal anaesthesia provides good pain management and facilitates spinal performance with wide patient acceptance, hence improving overall quality and efficiency of care.

A study done by Zhao et al used 20 ml of 0.375% ropivacaine to study USG guided suprainguinal FICB combined with a sacral plexus block for lower extremity surgery as suitable anaesthesia for patients with severe circulatory compromise.[35] In this case report a 46-year-old man with tuberculosis, chronic obstructive pulmonary disease, pulmonary heart disease, World Health Organization (WHO) class III pulmonary hypertension and right heart dysfunction, and American Society of Anaesthesiologists physical status class III needed fixation of an intramedullary nail in the left lower extremity. Additionally, he had broken his left lower limb after a recent fall. Both general anaesthesia and epidural anaesthesia were not appropriate. The patient had a clear history of tuberculosis, computerized tomography scan displayed destructive pneumonophthisis. Furthermore, he had chronic obstructive pulmonary disease and pulmonary heart disease. An ultrasound-guided SIFI combined with a sacral plexus block was successfully performed for surgical anaesthesia and avoided all hemodynamic fluctuations. They summarized that this compound nerve block is more suitable for elderly patients with severe cardiopulmonary insufficiency or unstable circulation. The only limitation was the expertise required by the anaesthetist to gain sufficient proficiency in performing these ultrasound guided blocks.

A study conducted by Kashyap et al on 60 subjects divided into two groups of 30 each, with group one being given FICB with 20 ml of 0.2% ropivacaine 15 mins before subarachanoid block, and group 2 being given IV fentanyl at 1 mcg/kg single dose 15 mins before the

subarachanoid block concluded that FICB provides positioning of the patient for spinal anaesthesia than IV fentanyl, and it prolongs the duration of first postoperative analgesia.[36] In this study, sixty patients aged 25 to 75 years, with American Society of Anaesthesiologists status I to III, undergoing surgery for femur fracture were chosen for the study and randomized into 2 groups. Patients in group FICB received the block with 30 mL of 0.375% ropivacaine 15 minutes before the subarachnoid block. Patients in group IVF received intravenous fentanyl at 0.5 µg/kg body weight repeated up to a maximum of 3 doses. Spinal was administered using 12 to 15 mg of 0.5% hyperbaric bupivacaine with glucose 80 mg/mL in patients of both groups. Pre-procedural and post-procedural parameters such as visual analogue scale (VAS) scores, sitting angle, quality of positioning, and time to perform the spinal were recorded. Patients were also assessed in the first 24 hours for analgesic requests. Pre-procedural VAS scores were similar in both groups. The "VAS after" was 24.72±15.70 mm in group FICB vs 61.22±18.18 mm in group IVF (P=.01). The drop in VAS scores was significantly more in the FICB group. Sitting angle improved significantly in the FICB group. (56.17°±16.54° vs 21.38°±23.90°; P=.01). Patients in group FICB also needed less time for spinal and had better quality of positioning. Postoperative analgesic requirement was lesser in group FICB. They concluded that fascia iliaca block offers superior analgesia compared to IVF in patients with femur fracture before positioning for spinal anaesthesia.

Another study conducted by Sabra et al in which the subarachnoid block was given at the L3-4 interspace, and then the patients were divided into three groups according to the drug given in the suprainguinal fascia iliaca after subarachnoid block and before skin incision: group C received 40 ml normal saline, group R received 40 ml ropivacaine 0.2%, and group D received a mixture of dexmedetomidine 2 µg/kg diluted in 0.2% ropivacaine with 40 ml total volume. The primary outcome was evaluation of postoperative analgesia using numerical rating scale, recorded at 30 min and at 1, 3, 6, 9, 12, 15, 18, 21, and 24 h. Analgesic consumption and first analgesic request were the secondary outcomes.

The numerical rating scale scores were significantly higher in group C when compared with groups R and D, at the 1, 3, and 6 h. Postoperative pethidine consumption during the first 24 h was found to be significantly less in group R and group D when compared with group C. There was a statistically significant difference in the group D when compared with group C and group R, with less number of patients who required rescue analgesic in 24 h and prolonged time for first request of rescue analgesic. The study concluded that the addition of dexmedetomidine to ropivacaine in FICB was efficacious in decreasing severity of pain, decreasing total analgesic consumption during the first 24 h, and prolonging the time for first request of analgesia in the postoperative period for patients undergoing hip arthroplasty.[37]

In a study by Yamada et al, the effective volume of 0.25% ropivacaine for ultrasound-guided supra-inguinal FICB to produce effective femoral nerve block and lateral cutaneous nerve block of thigh were 15.01 ml and 26.99 ml, respectively.[38] In this study, they studied 21 consecutive patients of ASA physical status I–III undergoing surgery for hip fracture who met the inclusion criteria. Blocks were performed before going to the operation room. They determined the injection volumes of 0.25% ropivacaine for consecutive patients from the preceding patient's outcome. The initial volume was 30 ml. The testing interval was set at 10 ml, and the lowest volume was 5 ml. An effective block was defined as loss of sensation of pinprick in the territory of the femoral nerve and lateral cutaneous nerve of the thigh 30 min after the injection. The aim of this study was to determine the 50% effective volume (EV_{50}) and the 95% effective volume (EV_{95}) of 0.25% ropivacaine for ultrasound-guided supra-inguinal FICB using Logistic regression analysis. EV_{50} and EV_{95} of 0.25% ropivacaine for ultrasound-guided supra-inguinal FICB calculated with logistic regression analysis were 15.01 ml (95% confidence interval, 6.53–22.99 ml) and 26.99 ml (95% confidence interval, 20.54–84.09 ml), respectively. $EV_{50}$and EV_{95} of 0.25% ropivacaine for ultrasound-guided supra-inguinal FICB were 15.01 ml and 26.99 ml, respectively.

Most reported dosing regimens in the literature favour a volume of 30–40 ml.

In a study by Stevens et al[11] they assessed whether a modified fascia iliaca compartment block in unilateral total hip arthroplasty provides a morphine-sparing effect in the first 24 hours. This involved a randomised, double blind study of 44 patients. Both groups received a modified fascia iliaca block with the trial group receiving 30 ml 0.5% bupivacaine with 1:200,000 adrenaline, 150 mcg clonidine and 9 ml 0.9% saline and the control group receiving 40 ml 0.9% saline. Otherwise both groups received identical care with a subarachnoid block for operative anaesthesia. Patient-controlled morphine analgesia was commenced postoperatively and data were collected at three, six, 12 and 24 hours post commencement of surgery. We found that the trial group used less morphine at 12 and 24 hours ($P < 0.001$). The median morphine usage at 24 hours was 37.5 mg in the control patients and 22 mg in the trial patients. Pain scores were similar between groups. They conclude that a modified fascia iliaca compartment block has a significant morphine-sparing effect in unilateral total hip arthroplasty.

A study by Kumar et al[12] was conducted to compare the analgesic efficacy of the two techniques of FICB for postoperative analgesia. The 40 patients scheduled for THA were recruited for Intervention (s) and randomized to receive FICB either by suprainguinal approach (group S) or infrainguinal approach (group I) for postoperative analgesia with 40 ml of 0.2% bupivacaine, in addition to postoperative patient controlled analgesia (PCA) with morphine. Visual analogue scale (VAS) and PCA morphine consumption was used to assess the postoperative pain at 3, 6, 12 and 24 hours. The primary outcome was cumulative PCA morphine consumption in 24 hours. The pain intensity as measured by VAS scores showed significant reduction of intensity at 6 hours post block in group S as compared to group I (median [IQR]; 2[0-3]; 3[2.25-3]; $p = 0.001$) but, there was no significant difference in VAS at 12 and 24 hours. Postoperatively, there was significant difference in time to first PCA morphine demand (356.28 ± 33.32 vs 291.48 ± 37.17, $p = < 0.001$, respectively) in-group S vs. group I. The postoperative morphine

consumption was also significantly less in group S compared to group I at 6, 12 and 24 hours and the cumulative morphine consumption in 24 hours (6.95 ± 2.14 vs 10.50 ± 2.24, p = < 0.001 respectively) was also less. In conclusion, in THA, suprainguinal approach of FICB has a superior postoperative analgesic efficacy compared to infrainguinal approach of FICB along with significantly less morphine consumption in first 24 hours.

The use of high doses of local anaesthetic increases the risk of local anaesthetic toxicity. Given that hip fracture patients tend to be underweight, volume for FICB is a critical factor.

Kris Vermeylen et al[39] reported volume needed to reach femoral nerve, lateral femoral cutaneous nerve, and obturator nerve in cadaver study. Adult cadavers weight between 55 and 72 kg were used in this study. The suggested volume to reach all three nerves was 40 ml, but a volume of 20–30 ml was enough to reach femoral nerve and lateral cutaneous nerve. The result was consistent with our result. In this pilot study, they aimed to determine the suggested volume needed to reach the three target nerves of the lumbar plexus (FN, ON, and LFCN) with a single-injection ultrasound-guided supra-inguinal fascia iliaca compartment (S-FICB). A computer tomography (CT scan)-guided step-up/step-down sequence was used to determine the suggested injection volume to target all three nerves. Subsequently, an anatomist blinded for the injected volume and CT findings, dissected the cadavers, and evaluated the spread of dye underneath the fascia iliaca. In total, seven pelvic areas of four cadavers were evaluated on CT scan and dissected. Distribution of dye underneath the FI in relation to the FN, ON, and the LFCN was recorded in all dissected cadavers. Combining CT and dissection findings, the suggested volume to reach the FN, ON, and LFCN with an S-FICB was 40 mL.

In a meta-analyses by KH Hong and Ma[31], to assess the effect of fascia iliaca compartment block (FICB) on pain control and morphine consumption in patients with hip fracture. They searched databases (PubMed, Embase, Cochrane Library) for eligible randomized controlled trials (RCTs) published prior to September 12, 2018. They only included

hip fracture patients who received FICB versus placebo for pain control. Risk ratios (RRs), standard mean differences (SMD) and 95% confidence intervals (CI) were determined. Stata 12.0 was used for the meta-analysis. Eleven trials involving 937 patients underwent hip fracture were retrieved. FICB significantly decreased the pain intensity at 1–8h and 48h. Moreover, FICB could reduced the total morphine consumption and the occurrence of nausea ($P < .05$). There was no significant difference between the pain intensity at 72h. Hence, they concluded that FICB has a beneficial role in reducing pain intensity and morphine consumption after hip fracture. Moreover, FICB has morphine-sparing effects when compared with a control group. More high-quality RCTs are needed to identify the optimal technique and volume of injectate for FICB.

In a trail by Thompson et al, Geriatric patients with fractures of the proximal femur (neck, intertrochanteric, or subtrochanteric regions) were prospectively randomized into an experimental (A) or control (B) groups. Forty-seven patients met inclusion criteria, 23 randomized to the experimental group and 24 to the control group. Patients randomized to the experimental group received an ultrasound-guided fascia iliaca compartment block administered by a board-certified anaesthesiologist immediately before the initiation of anaesthesia. Primary outcome measure was postoperative pain medication consumption until postoperative day 3. Secondary outcomes included functional recovery and a study-specific patient-reported satisfaction survey assessed on postoperative day 3. There was no significant difference in consumption of acetaminophen for mild pain, tramadol for moderate pain, or functional recovery between the 2 groups. There was a statistically significant decrease in morphine consumption (0.4 mg vs. 19.4 mg, P = 0.05) and increase in patient-reported satisfaction (31%, P = 0.01). Preoperative fascia iliaca compartment block significantly decreases postoperative opioid consumption while improving patient satisfaction. They recommended the integration of this safe and efficacious modality into institutional geriatric hip fracture protocols as an adjunctive pain control strategy.

Taken together, these studies suggest that, suprainguinal FICB is an affective post- operative analgesia for hip and lower limb (upto knee) surgeries as it has been reported to block the femoral, lateral femoral cutaneous and obturator nerves at the same time thereby decreasing pain, enhancing post-operative mobilization due to minimal motor blockade and minimizing the use of opioids in post- operative period leading to improved outcomes. Hence, we propose to evaluate the post-operative analgesic duration and efficacy of ultrasound guided suprainguinal FICB when administered using varying volumes of 0.2% ropivacaine, in patients undergoing hip and lower limb (upto knee) surgeries under spinal anaesthesia.

MATERIALS AND METHODS

SOURCE OF DATA

A randomized, double blind study was conducted in the Department of Anaesthesiology, Dayanand Medical College and Hospital, Ludhiana after approval by Institutional Ethics Committee on a total of 90 adult patients undergoing lower limb surgeries under subarachnoid block. These patients were divided into 3 study groups of 30 patients each by computer generated randomization codes contained in sealed, sequentially numbered envelopes. A written informed consent was obtained from each patient.

METHOD OF COLLECTION OF DATA

Inclusion Criteria:

- Patients scheduled for lower limb surgeries, including the hip and upto the knee joint
- ASA I, II and III patients
- Cognitive ability to comprehend NRS scale

Exclusion Criteria:

- Patient refusal
- Contraindications to the suprainguinal fascia iliaca compartment block (such as coagulopathies, infection at injection site, allergy to local anaesthetic)
- Patients on chronic opioid abuse
- Neuropathies

GROUP ALLOCATION:

A total of 90 patients were recruited for the study and an equal number of patients were allocated randomly using computer generated random number list to either of the 3 groups:

GROUP A: Comprised of 30 patients who received 20 ml of 0.2% ropivacaine in FICB.

GROUP B: Comprised of 30 patients who received 30 ml of 0.2% ropivacaine in FICB.

GROUP C: Comprised of 30 patients who received 40 ml of 0.2% ropivacaine in FICB.

The randomization scheme using computer generated random number was prepared by our biostatistician and the patients as well as the observer involved in the study were kept unaware of the group allocation. The allocation envelope were opened by an anaesthesiologist who was administering the block to the patient. This anaesthesiologist prepared the local anaesthetic solution as per random allocation sequence and perform the suprainguinal fascia iliaca compartment block. A blinded observer assessed preoperative and postoperative pain scores. These codes were decoded at the end of study period.

PRE-ANAESTHETIC CHECK UP:

Routine thorough pre-anaesthetic check up was conducted comprising of detailed history, comorbidities, allergy to any drug being used, general physical and systemic examination. Patients were explained about the study being conducted and written informed consent was taken and they were also educated on the use of NRS scale. Relevant investigations were sent and reviewed.

Demographic information including BMI, age and sex, type of lower limb surgery were recorded.

ANAESTHESIA TECHNIQUE:

On arrival in the operation theatre, patients were positioned on the operating table in the supine position and routine monitoring in the form of 5-lead electrocardiography, non-invasive blood pressure (NIBP), temperature and pulse oximeter were instituted. Heart rate (HR) was recorded using 5 lead electrocardiography and non-invasive blood pressure (NIBP) using an automated non-invasive device that was recycled every one minute until three consecutive measurements of systolic blood pressure (SBP) were recorded and mean of three readings was recorded as baseline.

The patient was then be administered a subarachnoid block after proper positioning in the the sitting position, cleaning and draping, with 2.5 ml of 0.5% bupivacaine heavy and 0.5 ml (25 mcg) of fentanyl via a 26G quincke needle.

After successfully administering the subarachnoid block, the anaesthesiologist stood on the side of the block. With the patient supine, a linear high frequency probe (6-14 MHz) was placed in the sagittal plane to obtain an image of the ASIS. The probe was then moved medially and the fascia iliaca and sartorius, iliopsoas, and internal oblique muscles identified. After identifying the 'bowtie sign' formed by the muscle fasciae, a 21-gauge, 100 cm stimuplex ultra 360 (B BRAUN) needle was introduced 1 cm cephalad to the inguinal ligament. Using an in-plane approach, the needle tip was positioned beneath the fascia iliaca, and hydro-dissection was used to separate the fascia iliaca from the iliacus muscle. The needle was then further advanced in this space in a cranial and slightly dorsal direction. An injection was considered successful if spread of LA is observed cranial to the point where the iliac muscle passes under the abdominal muscles. If adequate spread was not observed, the needle was repositioned.[22]

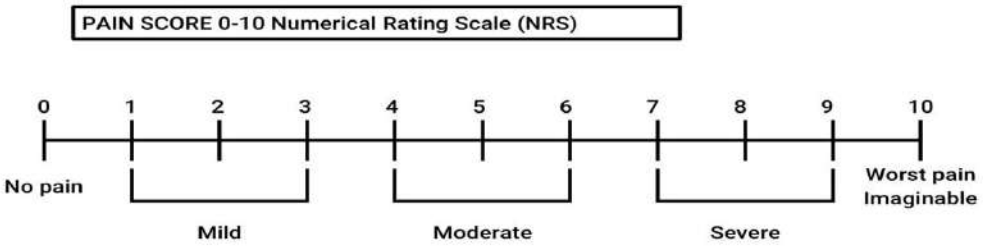
A proper injection was ensured by separation of fascia iliaca by the local anaesthetic in the medial-lateral direction.

FOLLOWING OUTCOMES WERE OBSERVED POSTOPERATIVELY:

PRIMARY OUTCOME:

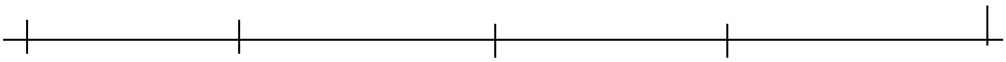
Was to evaluate the analgesic efficacy of varying volumes of local anaesthetic solution on pain management after suprainguinal fascia iliaca compartment block in postoperative period. This was evaluated using the following:

- Time to first request of analgesia- Duration of analgesia was defined as the time taken from the initiation of block to the time to first requirement of rescue analgesia at NRS scale for pain ≥4.
- Numeric rating scale for pain was recorded postoperatively, immediately on shifting to the PACU and then every hour for the first 4 hours and then 2 hourly for next 8 hours and then 4 hourly till 24 hours. The score was determined by asking the patient to rate the pain from 0-10, where in 0 being the least pain and 10 being the maximum.



SECONDARY OUTCOMES:

- Total requirement of analgesics in first 24 hours after surgery: this included tramadol and fentanyl.
- Patient satisfaction with the pain management: Patient satisfaction score was measured by asking the patient to rate their satisfaction on a 5-point Likert scale 24 hours after surgery.



Very satisfied satisfied neither satisfied nor dissatisfied dissatisfied very dissatisfied

- Injection tramadol 50 mg i/v was used as rescue analgesic whenever the NRS **≥** 4, to a maximum of 150 mg within 24 hours following which if still NRS>4 then another rescue analgesic, injection Fentanyl 1mcg/kg IV as a slow bolus was administered
- Injection paracetamol (1 gm IV 6 hourly) was given to all patients as a part of the multimodal analgesia as a part of our study, in the first 24 hours after the surgery.

STATISTICAL ANALYSIS

Data was described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups was done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test was performed and Fischer exact test was used when the expected frequency would be less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All

statistical calculations were done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

SAMPLE SIZE CALCULATION:

F tests - ANOVA: Fixed effects, omnibus, one-way

Analysis: Post hoc: Compute achieved power

Input: Effect size f = 0.3805187

α err prob = 0.05

Total sample size = 90

Number of groups = 3

Output: Noncentrality parameter λ = 13.031503

Critical F = 3.101296

Numerator df = 2

Denominator df = 87

Power (1-β err prob) = 0.898379

A post hoc power analysis was conducted using the software package, G*Power version 3.1.9.2 (Franz Faul, university kiel, Germany). The alpha level used for this analysis was $p<0.05$ and beta was 0.20. Sample size was estimated from the results of previous study[32,35,36] using the time to first request of analgesia as the parameter, which is the primary outcome of our study. Our sample size came out to be 30 subjects per group at power of 0.89 and with an effect size of 0.38 with 10% chance of error with α = 0.05, β = 0.20 and confidence interval of 95%.

OBSERVATIONS AND RESULTS

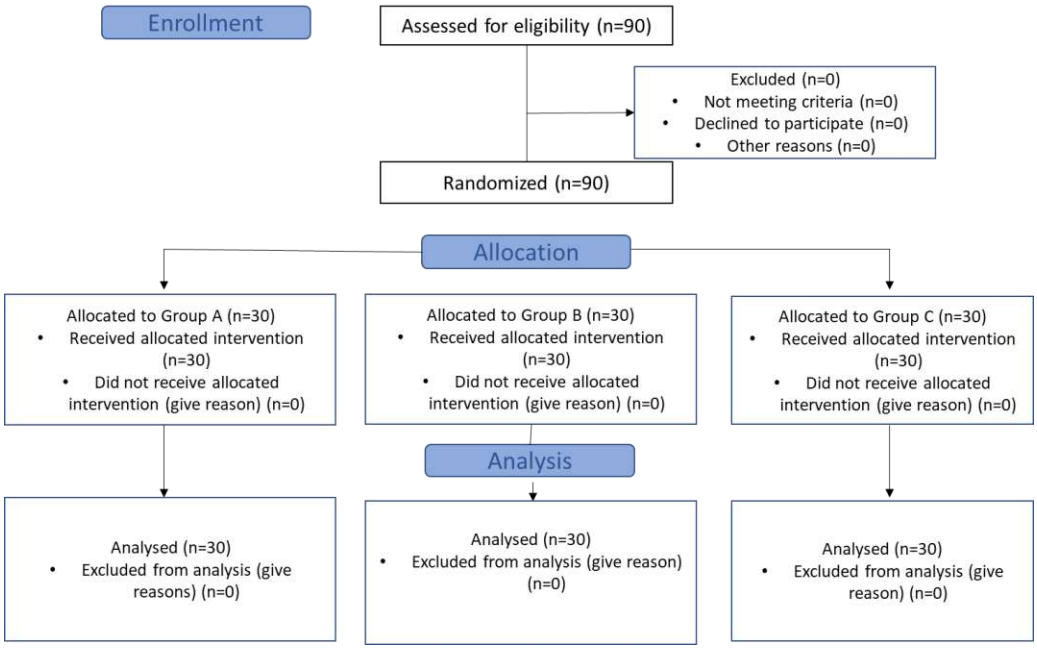
The present randomized control study was conducted in a prospective manner in the department of Anesthesiology, DMCH Ludhiana on a total of 90 patients scheduled for above knee orthopedic surgeries under spinal anaesthesia belonging to ASA grade I, II& III.

The study aimed to compare the different volumes of 0.2% ropivacaine in suprainguinal approach of fascia iliaca compartment block (FICB) with for post operative analgesia in patients undergoing above knee orthopedic surgeries.

The following outcomes were noted:

- Time to first request of rescue analgesia
- Total requirement of analgesics for pain management in first 24 hours
- To evaluate the patient satisfaction score

Figure 2: CONSORT Flow Diagram of the study


Enrollment
Assessed for eligibility (n=90)
Excluded (n=0)
Not meeting criteria (n=0)
Declined to participate (n=0)
Other reasons (n=0)
Randomized (n=90)
Allocation
Allocated to Group A (n=30)
Received allocated intervention (n=30)
Did not receive allocated intervention (give reason) (n=0)
Allocated to Group B (n=30)
Received allocated intervention (n=30)
Did not receive allocated intervention (give reason) (n=0)
Allocated to Group C (n=30)
Received allocated intervention (n=30)
Did not receive allocated intervention (give reason) (n=0)
Analysis
Analysed (n=30)
Excluded from analysis (give reasons) (n=0)
Analysed (n=30)
Excluded from analysis (give reason) (n=0)
Analysed (n=30)
Excluded from analysis (give reason) (n=0)

A total of 90 patients were enrolled for the study and all of them completed the study. They were divided in 3 groups of 30 patients each and were randomly allocated to either of the groups by computer generated random numbers. All of them received the interventions and

there were no dropouts. They were analyzed using SPSS 21 version statistical program for Microsoft Windows.

TABLE 1A: DEMOGRAPHIC PROFILE: DISTRIBUTION OF SUBJECTS ACCORDING TO AGE, GENDER, WEIGHT AND BMI

	Group A		Group B		Group C		F	p-value	A VS B	A VS C	B VS C
	Mean	SD	Mean	SD	Mean	SD			p-value	p-value	p-value
Age	65.57	10.21	61.63	20.79	58.03	19.47	1.396	0.253	0.386	0.098	0.427
Weight (Kg)	70.60	13.84	72.07	8.71	71.87	12.61	0.134	0.875	0.635	0.682	0.948
BMI (kg/m2)	25.38	4.00	26.72	3.52	24.95	3.17	2.008	0.140	0.316	0.889	0.139

TABLE 1B: DEMOGRAPHIC PROFILE: DISTRIBUTION OF SUBJECTS ACCORDING TO AGE, GENDER, WEIGHT AND BMI

		Group A		Group B		Group C		Total	chi-square value	p-value
		No. of cases	%age	No. of cases	%age	No. of cases	%age			
Sex	F	16	53.3%	14	46.7%	12	40.0%	42	1.071	0.585
	M	14	46.7%	16	53.3%	18	60.0%	48		
Total		30	100.0%	30	100.0%	30	100.0%	90		

All three groups were statistically comparable in respect to the demographic data.

Mean age in group A was 65.57 +/- 10.21 years, in group B it was 61.63 ± 20.79 years and in group C it was 58.03 +/- 19.47 years. Mean weight was 70.60 ± 13.84 kgs, 72.07 ± 8.71 kgs and 71.87 +/- 12.61 kgs in groups A, B and C respectively. Mean BMI being 25.38 ± 4.0 kg/m2, 26.72 ± 3.52 kg/m2 and 24.95 +/- 3.17 kg/m2 in group A, B and C respectively.

In group A 53.3% of the patients were females, in group B 46.7% of the patients were females and in group C 40 % were females. The distribution of subjects across both groups were comparable.

FIGURE 3A: DISTRIBUTION OF SUBJECTS ACCORDING TO AGE

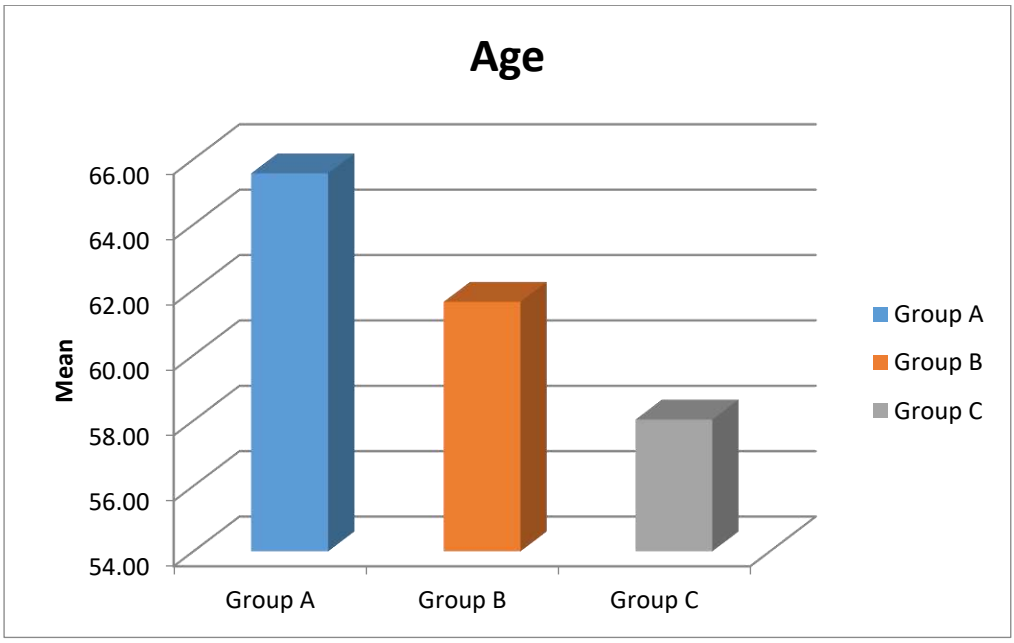


FIGURE 3B: DISTRIBUTION OF SUBJECTS ACCORDING TO WEIGHT

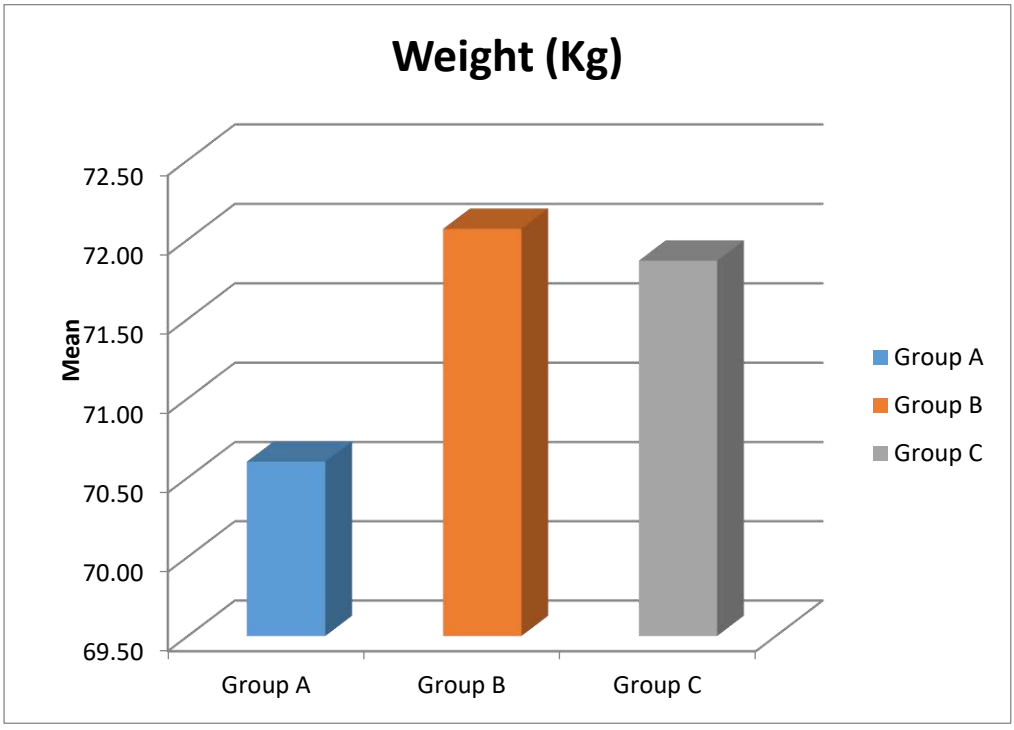


FIGURE 3C: DISTRIBUTION OF SUBJECTS ACCORDING TO BMI

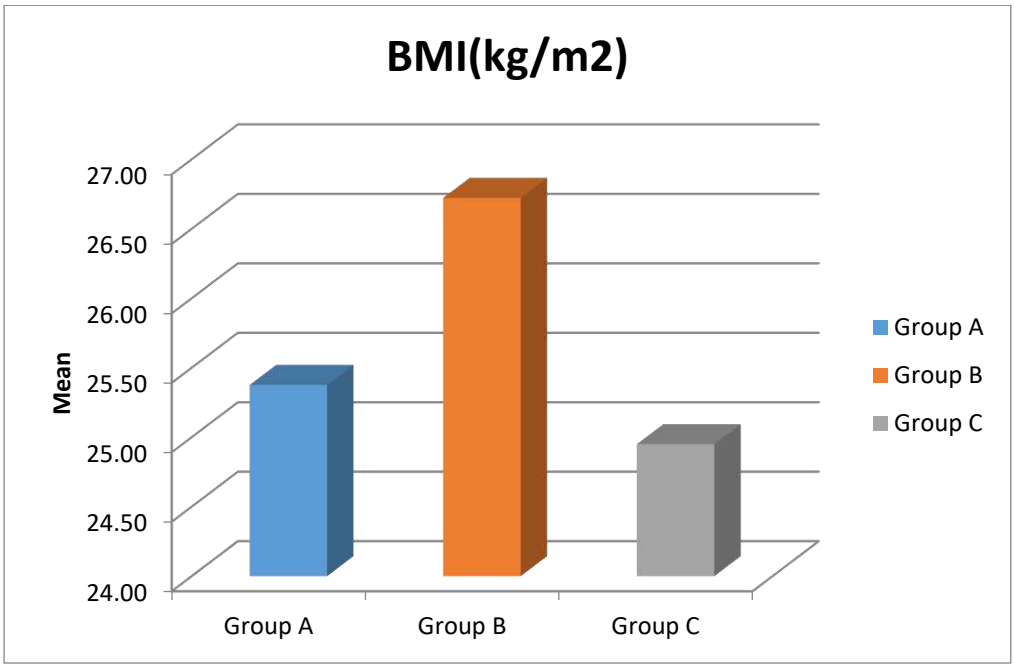


FIGURE 3D: DISTRIBUTION OF SUBJECTS ACCORDING TO GENDER

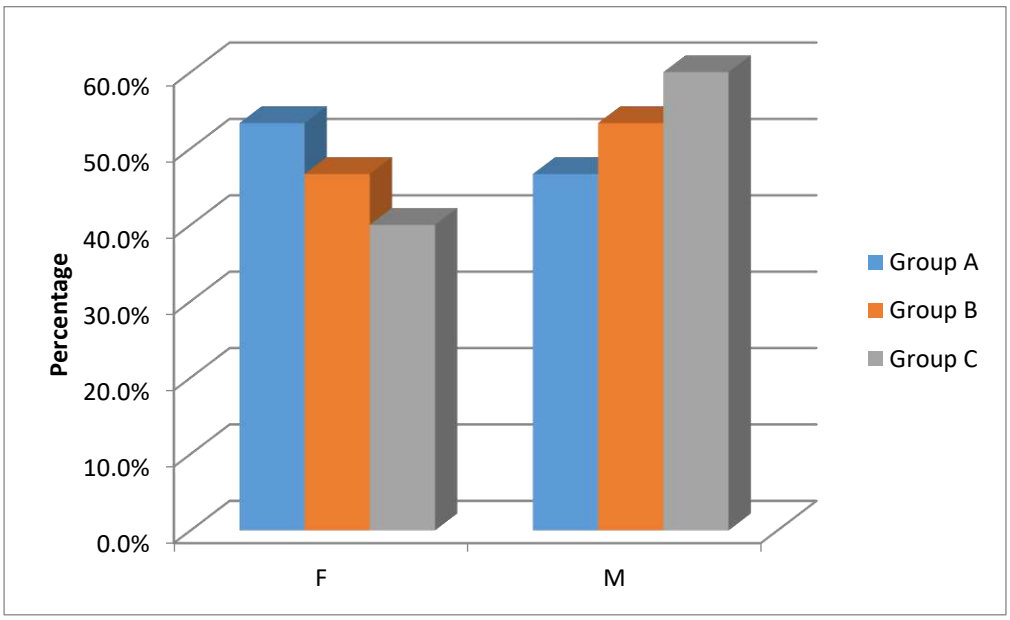


TABLE 2: DISTRIBUTION OF SUBJECTS ACCORDING TO ASA GRADE

		Group A		Group B		Group C		Total	chi-square value	p-value
		No. of cases	%age	No. of cases	%age	No. of cases	%age			
ASA grade	1	1	3.3%	3	10.0%	5	16.7%	9	4.111	0.391
	2	10	33.3%	8	26.7%	11	36.7%	29		
	3	19	63.3%	19	63.3%	14	46.7%	52		
Total		30	100.0%	30	100.0%	30	100.0%	90		

In group A, 3.3% patients belonged to ASA I, 33.3% belonged to ASA II, and 63.3% belonged to ASA III. In group B, 10% patients belonged to ASA I, 26.7% belonged to ASA II, and 63.3% belonged to ASA III. In group C 16.7% patients belonged to ASA I, 36.7% belonged to ASA II, and 46.7% belonged to ASA III. Both the groups were statistically comparable.

FIGURE 4: DISTRIBUTION OF SUBJECTS ACCORDING TO ASA GRADE

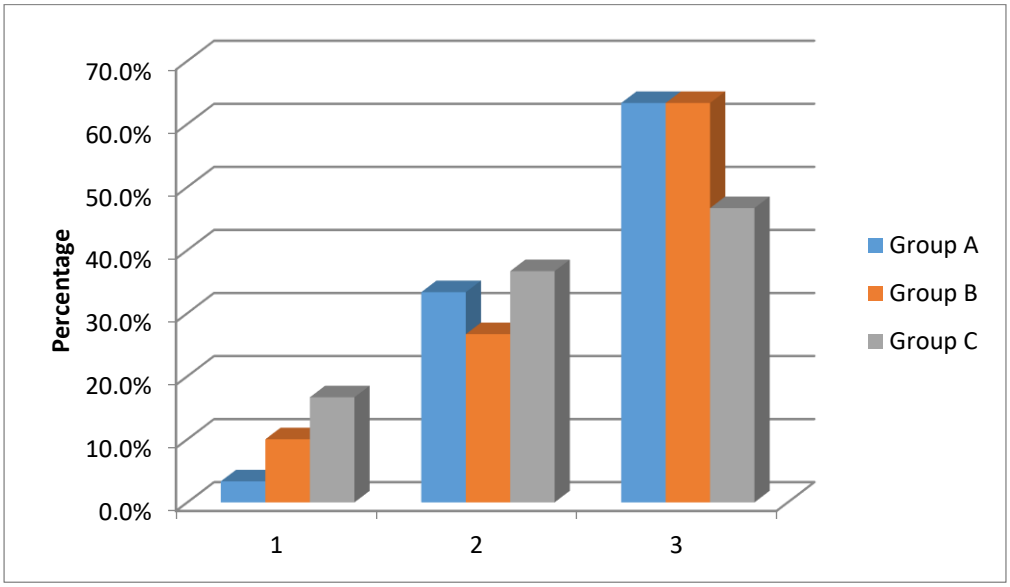


TABLE 3: MEDIAN DURATION OF SURGERY (in minutes)

	Group A		Group B		Group C		F	p-value	A VS B	A VS C	B VS C
	Mean	SD	Mean	SD	Mean	SD			p-value	p-value	p-value
Duration of Sx (in mins)	103.83	17.80	110.67	29.96	104.00	22.68	0.791	0.457	0.515	1.000	0.532

The median duration of surgery was comparable in all three groups.

Figure 5: MEDIAN DURATION OF SURGERY

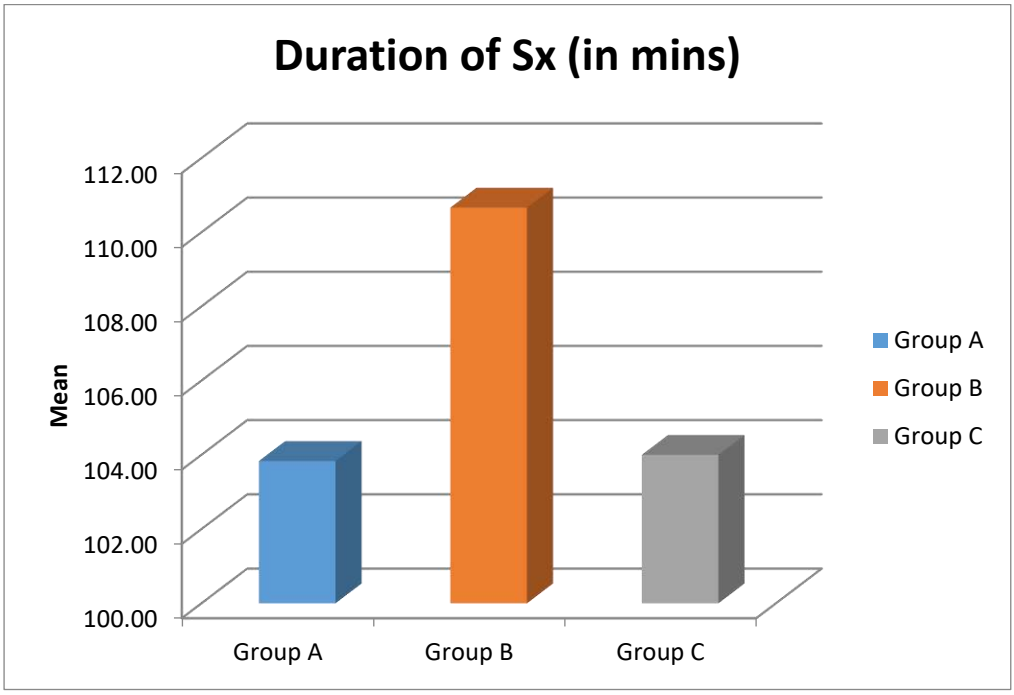


TABLE 4: DISTRIBUTION OF SUBJECTS ACCORDING TO TYPE OF SURGERY

		Group A		Group B		Group C		Total	chi-square value	p-value
		No. of cases	%age	No. of cases	%age	No. of cases	%age			
Type of Sx	debridment&STSG	0	0.0%	1	3.3%	0	0.0%	1	28.656	0.095
	distal femur plating	0	0.0%	1	3.3%	1	3.3%	2		
	femur implant removal	0	0.0%	1	3.3%	3	10.0 %	4		
	femur nailing	1	3.3%	3	10.0%	9	30.0 %	13		
	femur plating	1	3.3%	0	0.0%	0	0.0%	1		
	Hemiarthroplasty	13	43.3%	9	30.0%	6	20.0 %	28		
	ORIF Femur Right	0	0.0%	0	0.0%	1	3.3%	1		
	ORIF shaft femur	0	0.0%	2	6.7%	0	0.0%	2		
	PFN	15	50.0%	13	43.3%	9	30.0 %	37		
	wound exploration left hip	0	0.0%	0	0.0%	1	3.3%	1		
Total		30	100.0%	30	100.0 %	30	100.0 %	90		

In group A, 3.3% , 3.3% , 43.3% , and 50% of subjects underwent femur nailing, femur plating, hemiarthroplasty, and proximal femur nailing respectively. In group B, debridement and split thickness skin grating, distal femur plating, femur implant removal, femur nailing, hemiarthroplasty, open reduction and internal fixation (ORIF) shaft femur and proximal femur nailing was performed in 3.3%, 3.3%, 3.3%, 10%, 30%, 6.6% , and 50% of subjects respectively. In group C, 3.3%, 10%, 30% , 20% , 3.3% , 30% , and 3.3% patients underwent distal femur plating, femur implant removal, femur nailing, hemiarthroplasty, ORIF femur, proximal femur nailing and wound exploration of hip respectively. This overall distribution of subjects in regard to type of surgery was comparable in both groups.

FIGURE 6: DISTRIBUTION OF PATIENTS ACCORDING TO TYPE OF SURGERY

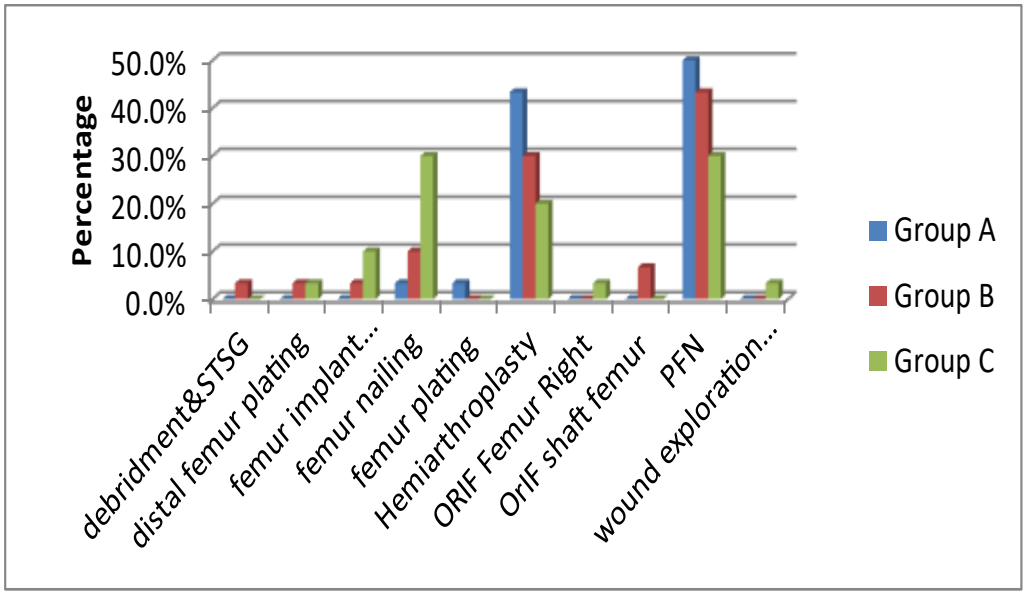


TABLE 5: TRENDS IN MEAN NRS SCORE AT REST IN PACU

	Group A		Group B		Group C		F	p-value	A VS B	A VS C	B VS C
	Mean	SD	Mean	SD	Mean	SD			p-value	p-value	p-value
NRS_0 hr	0.03	0.18	0.10	0.40	0.00	0.00	1.194	0.308	0.572	0.869	0.288
NRS_1st hr	0.83	0.53	0.37	0.81	0.37	0.72	4.500	0.014	0.029	0.029	1.000
NRS_2nd Hr	1.23	0.63	0.70	1.06	0.70	0.99	3.439	0.037	0.065	0.065	1.000
NRS_3rd hr	1.80	0.66	1.13	0.97	0.70	0.47	17.209	0.000	0.002	0.000	0.062
NRS_4th hr	2.27	0.64	1.47	0.90	1.33	0.71	13.301	0.000	0.000	0.000	0.775
NRS_6th hr	2.77	0.63	2.13	1.57	1.60	0.56	9.674	0.000	0.050	0.000	0.116
NRS_8th hr	3.77	1.28	2.00	0.98	1.53	0.57	42.697	0.000	0.000	0.000	0.166
NRS_10th hr	3.60	1.10	2.33	1.32	1.93	0.69	19.811	0.000	0.000	0.000	0.152
NRS_12th hr	2.97	0.76	2.20	1.19	2.20	0.71	7.047	0.001	0.005	0.005	1.000
NRS_15th hr	3.47	1.43	2.43	1.28	2.80	1.45	4.273	0.017	0.014	0.157	0.564
NRS_18th hr	3.07	1.48	2.03	1.35	1.50	0.78	12.327	0.000	0.005	0.000	0.226
NRS_24th hr	1.63	0.67	1.47	0.78	1.33	0.71	1.307	0.276	0.644	0.245	0.754

Statistically significant reduced NRS scores were observed at rest in group B and C than group A at all hours except the 24th hour.

FIGURE 7: TRENDS IN MEAN NRS SCORE AT REST IN PACU

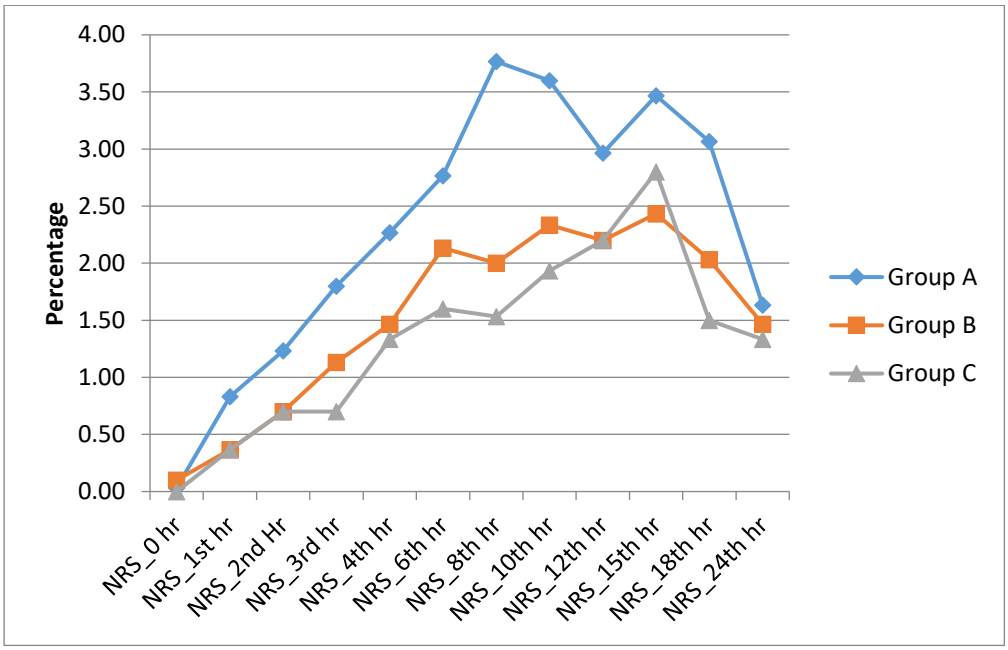


TABLE 6: TIME TO REQUEST OF FIRST ANALGESIA (in mins)

	Group A		Group B		Group C		F	p-value	A VS B	A VS C	B VS C
	Mean	SD	Mean	SD	Mean	SD			p-value	p-value	p-value
Time to request of first analgesia (in mins)	577.83	138.95	728.26	313.96	937.35	31.33	17.200	0.000	0.025	0.000	0.005

Mean duration of analgesia was defined as the time from administering the block to the time of first requirement of rescue analgesic at NRS ≥4. The mean duration of analgesia was 577.83 +/- 138.95 mins in group A, 728.26 +/- 313.96 mins in group B and 937.35 +/- 31.33 mins in group C. The difference was statistically significant among all three groups (with p value, p=0.023).

Seven patients of group B and thirteen patients of group C never complained of pain at any point of time during 24 hours with NRS ranging between 0-3

FIGURE 8: TIME TO REQUEST OF FIRST ANALGESIA (in mins)

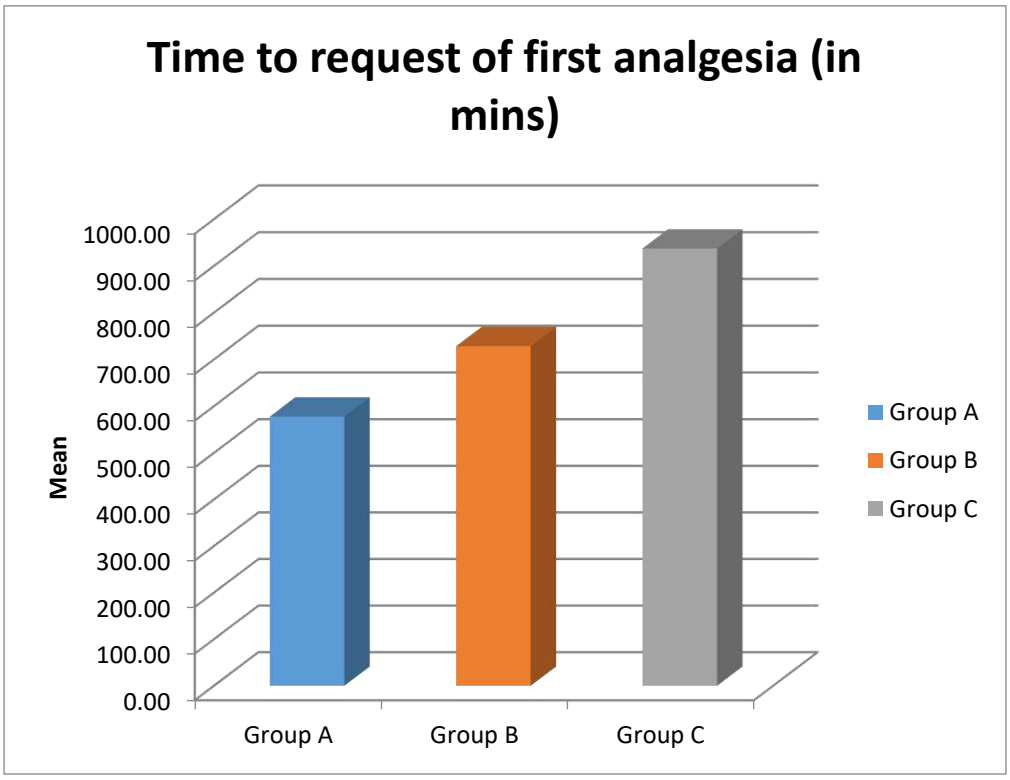


TABLE 7: MEDIAN (IQR) ANALGESIC CONSUMPTION IN 24 HOURS POST OPERATIVELY

	Group A		Group B		Group C		F	p-value	A VS B	A VS C	B VS C
	Mean	SD	Mean	SD	Mean	SD			p-value	p-value	p-value
Total Tramadol (in mg)	86.67	22.49	58.70	19.38	50.00	0.00	26.197	0.000	0.000	0.000	0.312
At 12 Hours	50.00	0.00	50.00	0.00	.	.	.	.			
At 24 Hours	86.67	22.49	58.70	19.38	50.00	0.00	26.197	0.000	0.000	0.000	0.312
Cumulative Analgesic Consumption (of tramadol in mg)	131.67	33.43	91.30	51.46	50.00	0.00	27.405	0.000	0.001	0.000	0.002

Median values of total rescue analgesic consumption in the 24 hours post-operative period was significantly less in group C as compared to group B and group A patients (with p value (p=0.001)

FIGURE 9: MEDIAN (IQR) ANALGESIC CONSUMPTION IN 24 HOURS POST-OPERATIVELY

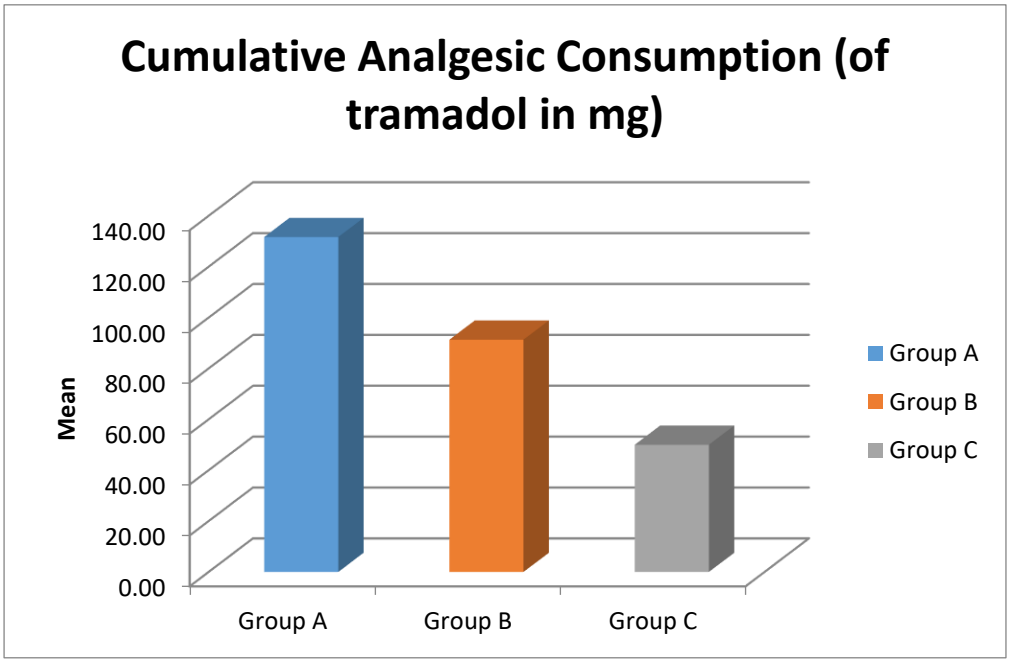
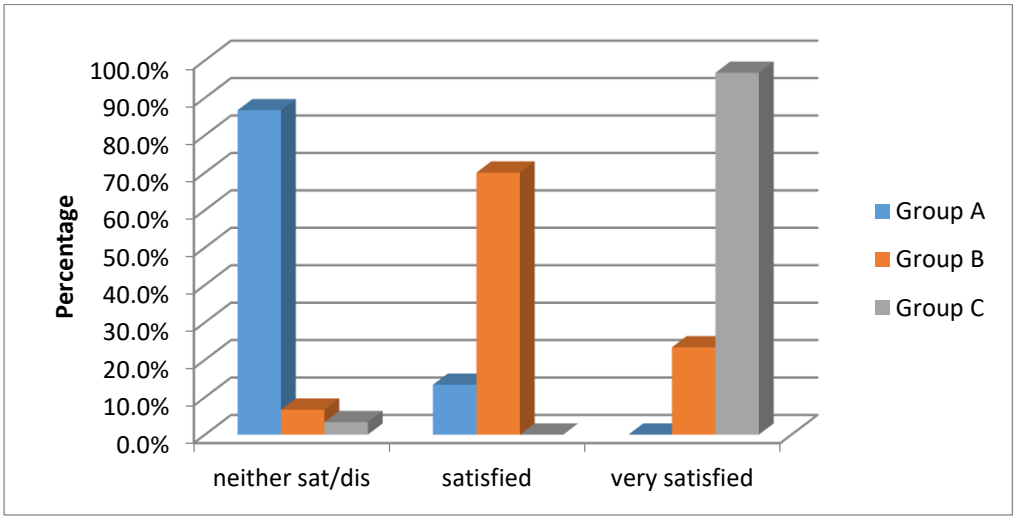


TABLE 8: QUALITY OF BLOCK AS ASSESSED BY PATIENT SATISFACTION SCORE AT THE END OF 24 HOURS POST OPERATIVELY

		Group A		Group B		Group C		Total	chi-square value	p-value
		No. of cases	%age	No. of cases	%age	No. of cases	%age			
Pt satisfaction	neither sat/dis	26	86.7%	2	6.7%	1	3.3%	29	109.455	0.001
	satisfied	4	13.3%	21	70.0%	0	0.0%	25		
	very satisfied	0	0.0%	7	23.3%	29	96.7%	36		
Total		30	100.0%	30	100.0%	30	100.0%	90		

In group A, 86.7% and 13.3% of patients were neither satisfied nor dissatisfied and satisfied respectively while in group B , 6.7% subjects were neither satisfied nor dissatisfied and 23.3% and 70% subjects were very satisfied and satisfied respectively. Meanwhile, in group C, 3.3% patients were neither satisfied nor dissatisfied, while 96.7% patients were very satisfied.

FIGURE 10: QUALITY OF BLOCK AS ASSESSED BY PATIENT SATISFACTION SCORE AT THE END OF 24 POST-OPERATIVELY



DISCUSSION

Post-operative pain relief after hip and femur surgeries is a challenge for the anaesthesiologist, as pain relief is essential for fast tracking early rehabilitation. An ideal analgesic regimen is important to attenuate stress response in the post-operative period. Inadequate pain control may lead to serious medical issues such as tachycardia, myocardial ischemia, and venous thromboembolism[40].

Surgeries of hip and femur such as hemiarthroplasty, distal femur plating, proximal femur nailing, etc are known to be associated with moderate to severe post operative pain, especially in the first 24 hours post-operatively. The pain is primarily due to extensive bony and soft tissue damage. The site of skin incision in majority of these surgeries is in the junction of medial and lateral thigh and about 2cm from the ASIS. The femoral and lateral cutaneous nerve of thigh cover the cutaneous distribution of this area. The Fascia lata and the Vastus muscles which are retracted during the procedure are supplied by the femoral nerve.

Conventionally, patients receive systemic analgesia, such as intravenous opioids and NSAIDs, or regional analgesia for post-operative pain relief. Systemic opioids and NSAIDs are associated with various side effects. Traditional surgical anaesthesia methods for hip fracture mostly involve epidural anaesthesia. Although this meets the needs of surgical treatment, pain sensation tends to return early after surgery. Epidural analgesia after surgery provides good analgesia, but it has fallen out of favour as anticoagulants and early ambulation are often considered necessary.[41]

Peripheral nerve blocks (PNBs), such as the supra-inguinal fascia iliaca compartment block (FICB) can efficiently reduce pain associated with lower limb surgeries. They also contribute to reduced rates of delirium, respiratory depression, nausea, vomiting and motor blockade which are the most common side effects seen with parenteral opioids, NSAIDs and central neuraxial blocks.[42,43]

Peripheral nerve blocks administered under ultrasound guidance have the benefit of direct visualization of nerves and other anatomical

structures like vessels, muscles, bones and fascias, real-time control of needle advancement, assessment of local anaesthesia spread around the nerves and supplementary injections in case of insufficient spread.[44] Ultrasound guidance shortens the block performance time, reduces the number of needle insertions and shortens the block onset time. It also allows reduction in the local anaesthetic dose.[45] There's reduction in failure rate with ultrasound guidance as compared to the landmark technique.

The fascia iliac compartment block has the potential to create a sensory block of the femoral, obturator, and lateral femoral cutaneous nerves. Compared with the classical infra-inguinal approach, the supra-inguinal approach to FICB has a higher likelihood of success in blocking these three nerves, resulting in better pain relief.[46]

Specific indications for the FICB which have been studied include hip fractures, femoral shaft fractures, and burns.[47]

The effectiveness of the FICB in comparison to other peripheral nerve blocks has been established in various studies, but there are very few studies comparing different volumes of local anaesthetic used for the block, in achieving successful postoperative analgesia in hip and femur surgeries.

We chose to use 0.2% ropivacaine due to its significantly low neurotoxic and cardiotoxic potential. In addition, it results in a lower incidence of motor blockade secondary to motor sensory differentiation, thereby further supporting early mobilization and safety in post-operative period.[48]

Our study aimed to compare efficacy of different volumes of 0.2% ropivacaine, i.e. 20 mL, 30 mL and 40 mL, administered under ultrasound guidance in the supra-inguinal FICB for post-operative pain relief in terms of time taken to first request of rescue analgesia (IV tramadol) at NRS >/= 4, cumulative total requirement of analgesics for pain management in first 24 hours by the three groups, and patient satisfaction score with pain management in patients undergoing above knee lower limb surgeries under subarachnoid block.

In our study, both the groups were statistically comparable with respect to demographic profile, type and duration of surgery and anaesthesia. Hence, the comparable confounders did not have the ability to bias our results.

The time to request of analgesia, defined as time taken in minutes from the initiation of block to first requirement of rescue analgesia at NRS >/= 4, in our study was significantly prolonged in group B (728.26 +/- 313.96 mins) and group C (937.35 +/- 31.33 mins) than in group A (577.83 +/- 138.95 mins). The total requirement of analgesics in first 24 hours after surgery, in terms of IV tramadol, was significantly lower in group C (50 mg) as compared to group B (91 mg) and group A (131 mg). We observed statistically significantly decreased NRS scores in group B and group C as compared to group A at predominantly all measurement time points of the study in post-operative period. Quality of block assessed by patient satisfaction score at the end of 24 hours was also significantly better with group B and group C as compared to group A. These findings imply superior analgesic efficacy of 30 mL and 40 mL over 20 mL of 0.2% ropivacaine in supra-inguinal FICB.

A randomized controlled trial was conducted by Yamada et al [38] to determine the 50% effective volume (EV50) and 95% effective volume (EV95) of 0.25% ropivacaine in ultrasound guided supra-inguinal FICB. An effective block was defined as loss of sensation of pinprick in the territory of the femoral nerve and lateral cutaneous nerve of the thigh 30 min after the injection. EV_{50} and EV_{95} of 0.25% ropivacaine for ultrasound-guided supra-inguinal FICB calculated with logistic regression analysis were 15.01 ml (95% confidence interval, 6.53–22.99 ml) and 26.99 ml (95% confidence interval, 20.54–84.09 ml), respectively. The use of the smallest possible volume of local anesthetics to block the major nerves would improve the safety of nerve blocks. These results are in concordance with the findings of our study, where 30 mL of 0.2% ropivacaine in ultrasound guided FICB provided significantly prolonged time to request of rescue analgesia, reduced total

requirement of IV tramadol and better patient satisfaction scores, as compared to lower doses of ropivacaine.

Another randomized controlled trial conducted by Desmet et al[32], hypothesized that a higher dose of ropivacaine (0.5%) is essential for successful analgesia in supra-inguinal FICB. They used 40 mL of 0.5% ropivacaine in the test group and no block was given in the control group. They observed that the mean (SD) morphine consumption at 24 hours postoperatively was reduced in group FICB compared to control group: 10.25 (1.64) mg versus 19.0 (2.4) mg (P = 0.004). Also they used a mean dose of 2.6-mg/kg ropivacaine (range, 2-3.4 mg/kg), none of the patients had total or free ropivacaine levels above the maximum tolerated serum concentration. We observed similar results in our study, where we safely administered higher volume (40 mL) of 0.2% ropivaciane in supra-inguinal FICB and observed significantly prolonged pain free periods, reduced total IV tramadol requirement in 24 hour post-operative period and better patient satisfaction with pain management.

A preliminary cadaveric study conducted by Vermeylen et al[39], observed the spread of different volumes in a single-injection supra-inguinal FICB in cadavers via computer tomography (CT) scan as well as dissection by blinded anatomist. They observed that 20 mL volume spread to the FN and LFCN but not the ON. Combined CT scan and dissection findings showed that 40 mL injection adequately spread to all three nerves, i.e. FN, LFCN and ON. 40 mL injection also showed better spread to psoas muscle and ON as compared to 30 mL. These findings are in accordance to the observations of our study where 40 mL of 0.2% ropivacaine in supra-inguinal FICB, as compared to 30 mL and 20 mL, showed prolonged pain free periods, significantly reduced requirement of IV tramadol and better patient satisfaction in 24 hour post-operative period.

A double-blinded comparative study was conducted by Helayel et al[49], to calculate the effective volume of 0.5% ropivacaine and 0.5% bupivacaine in 50% (EV50%), 95% (EV95), and 99% (EV99) of the cases to achieve fascia iliaca compartment block. The success of the block was defined as a complete sensitive block of the anterior, medial,

and lateral regions of the thigh. The volume of anaesthetic capable of producing an effective nervous anaesthesia in 50% of the cases, were observed to be 28.79 mL (CI 95%: 26.31 - 31.5 mL) for ropivacaine, and 29.56 mL (CI 95%: 25.22 - 34.64 mL) for bupivacaine (p = 0.62). The effective volumes of ropivacaine capable of effectively nervous anaesthesia in 50%, 95%, and 99% of the cases were estimated by prohibits regression as 28.8 mL (27.2 - 30.4), 34.3 mL (32.5 - 37.3), and 36.6 mL (34.3 - 40.5), respectively. The corresponding volumes of bupivacaine were 29.5 mL (28.1 - 31.1), 36.1 mL (33.5 - 38.1), and 37.3 mL (35.1 - 41.3) (p > 0.05). In our study, we observed similar findings, where 30 mL and 40 mL of 0.2% ropivacaine provided better 24 hour postoperative pain relief in terms of prolonged duration of analgesia, reduced IV tramadol requirement and better patient satisfaction.

The patients in our study did not exhibit respiratory depression, pruritus, nausea, and vomiting, due to the opioid sparing effects of the supra-inguinal FICB.

In our study, we gave single shot FICB over continuous FICB as it is simpler and easy to administer with comparable opioid sparing effect. Continuous FICB requires insertion of perineural catheters which are expensive and require maintenance. Further studies with continuous blockade can help to ensure efficacy of these blocks for extended period in various surgeries.

Patients of hip and lower limb surgeries benefit from early mobilization. Adequate muscle strength post-operatively would enable early movement of the lower limb. There are chances that the supra-inguinal FICB may hamper this due to quadriceps muscle weakness. A study of Aliste et al[50] reported higher incidence of quadriceps motor block with Supra-inguinal FICB than PENG block following THA but could not quantitatively measure using a dynamometer. A recent study by YS Choi[51] proved that quadriceps muscle weakness was comparable in both the groups. We did not assess quadriceps muscle weakness in our study and would suggest further researchers to study the effect of FICB on quadriceps muscle strength.

There were a few limitations in our study that could be assessed by future studies. First, the anaesthesiologist administering the blocks couldn't be blinded, however, we tried to which was overcome it by blinding the person recording the NRS scores. Secondly, all patients received spinal anaesthesia which could be a confounding factor resulting in variable effect on post operative analgesic requirement. For this purpose, patients enrolled in this study were of similar demographic characteristics and a standard dose of 12.5 mg Bupivacaine was used with 25 microgram Fentanyl.

But despite these limitations, our study design offered one major advantage by administering the blocks using Ultra Sound guidance resulting in better success rates in terms of analgesic efficacy.

We thus conclude from the results of our study that larger doses of 0.2% ropivacaine, such as 30 mL and 40 mL, in supra-inguinal FICB as compared to 20 mL result in significantly longer duration of analgesia, significantly reduced cumulative 24 hour post-operative period analgesic requirement with significant reduction in pain scores and improved patient satisfaction with pain management after lower limb surgeries.

SUMMARY & CONCLUSION

The present study was conducted in the department of Anaesthesiology, Dayanand Medical College and Hospital, Ludhiana after getting approval from the Institutional Ethical Committee. The aim was to compare the analgesic efficacy of USG guided suprainguinal fascia iliaca compartment block (FICB) using different volumes, i.e. 20 mL, 30 mL and 40 mL of 0.2% ropivacaine for post-operative pain relief in hip and lower limb (up to knee) surgeries. Ninety patients belonging to ASA grade I, II or III scheduled for hip or lower limb surgeries under spinal anaesthesia were included in a randomized, double blind manner after obtaining a written informed consent. Patients were randomly allocated using computer generated random numbers to one of the three groups:

GROUP A:

Comprising of 30 patients each of whom received 20 mL of 0.2% ropivacaine in suprainguinal FICB

GROUP B:

Comprising of 30 patients each of whom received 30 mL of 0.2% ropivacaine in suprainguinal FICB

GROUP C:

Comprising of 30 patients each of whom received 40 mL of 0.2% ropivacaine in suprainguinal FICB

The block was performed under USG guidance using a high frequency curvilinear probe (6-14 MHz) with patient in supine position by an experienced anaesthesiologist after administration of spinal anaesthesia.

After administration of suprainguinal FICB, patients were assessed for time to first request of analgesia (tramadol at NRS > 4) in minutes, total requirement of analgesics in first 24 hours after surgery, NRS score in first 24 hours after surgery and patient satisfaction with pain management. Results were analysed statistically.

We observed that 1) time to first request of analgesia was significantly prolonged in group B (728.26 +/- 313.96 mins) and group C (937.35 +/- 31.33 mins) as compared to group A (577.83 +/- 138.95 mins).

2) Total requirement of analgesics in first 24 hours after surgery was significantly less in group B and group C as compared to group A.

3) NRS scores were statistically significantly reduced at rest in group B and C than group A at all hours except the 24th hour.

4) The block assessed by patient satisfaction score was also significantly better in group B and C as compared to group A.

Hence, from the results of our study we conclude that 30 mL and 40 mL of 0.2% ropivacaine in suprainguinal FICB is efficacious in significantly reducing pain in post-operative period after hip and lower limb surgeries.

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S. No.	MRD	INTIALS	Group	Age	Sex	Date of Sx	Type of Sx	Duration of Sx (in mins)	Weight (Kg)	Height	BMI (kg/m2)	ASA grade	consciousness	Pre-operative HR	Pre-operative SBP	Pre-operative DBP	Pre-operative SpO2
1	1032111	BDG	B	82	F	24-02-2021	Hemiarthroplasty	90	70	5'3"	27.3	2	alert	120	150	90	99
2	1057230	V	B	89	F	23-03-2021	PFN	130	73	5'2"	29.4	2	alert	92	146	66	94
3	268027	RK	B	50	F	14-04-2021	Hemiarthroplasty	105	65	5'4"	24.6	3	alert	82	190	110	96
4	1091471	MS	B	35	M	21-04-2021	PFN	150	80	5'9"	26	2	alert	94	130	70	98
5	1094087	PC	B	67	M	24-04-2021	Hemiarthroplasty	120	85	5'9"	27.7	2	alert	94	150	90	95
6	1093220	JS	B	55	M	26-04-2021	PFN	150	78	5'6"	27	3	alert	104	160	90	99
7	3626	K	B	73	F	09-02-2021	PFN	120	70	5'0"	30.1	3	alert	88	140	90	96
8	1037085	VR	B	47	M	04-03-2021	PFN	75	74	5'7"	25.6	3	alert	88	128	76	98
9	1125731	SS	B	27	M	26-05-2021	femur nailing	60	67	5'8"	22.5	1	alert	110	120	70	98
10	1010875	US	B	83	M	03-07-2021	Hemiarthroplasty	50	67	5'4"	25.4	3	alert	89	130	90	97
11	1131006	BR	B	71	M	03-07-2021	Hemiarthroplasty	100	68	5'6"	24.2	3	alert	90	140	90	97
12	1016986	SD	B	70	F	15-07-2021	PFN	120	88	5'3"	34.4	3	alert	90	120	70	99
13	1140962	SR	B	76	F	23-07-2021	PFN	120	70	5'3"	27.3	3	alert	82	130	80	98
14	591665	MB	B	90	M	06-02-2021	Hemiarthroplasty	120	65	5'7"	22.4	3	alert	90	150	90	97
15	403718	BS	B	53	M	24-06-2021	femur implant removal	120	78	5'6"	27.8	2	alert	78	130	86	98
16	1168668	KS	B	56	F	07-09-2021	PFN	90	78	5'2"	31.5	3	alert	92	140	90	98
17	621833	PA	B	58	F	23-05-2022	Hemiarthroplasty	90	80	5'2"	33.1	3	alert	90	110	60	96
18	1308093	VS	C	50	M	21-05-2022	femur nailing	120	90	6'0"	26.9	3	alert	96	150	90	99
19	1308004	LS	B	15	M	21-05-2022	distal femur plating	150	60	5'9"	19.5	1	alert	100	110	70	99
20	1306584	VS	B	20	M	19-05-2022	femur nailing	90	76	6'0"	22.7	1	alert	84	110	70	98
21	1304254	B	A	56	M	16-05-2022	PFN	90	72	5'4"	27.2	2	alert	101	150	90	100
22	1304190	KJ	B	57	F	17-05-2022	femur nailing	190	68	5'0"	29.3	3	alert	81	120	80	96
23	126574	KC	B	64	F	12-05-2022	Hemiarthroplasty	120	60	5'1"	25	3	alert	90	140	90	97
24	1302402	HK	C	85	F	12-05-2022	PFN	90	50	5'0"	21.5	2	alert	89	150	80	97
25	1300316	DS	B	23	M	09-05-2022	debridment&STSG	90	65	5'7"	22.4	2	alert	94	120	80	98
26	1209984	BS	C	71	M	09-05-2022	Hemiarthroplasty	120	65	5'9"	21.2	1	alert	79	130	80	96
27	146719	B	A	63	M	10-05-2022	Hemiarthroplasty	100	68	5'2"	27.4	3	alert	91	130	80	99
28	1291797	JS	C	25	F	22-04-2022	distal femur plating	120	80	5'7"	27.6	3	alert	77	140	90	97
29	1292069	N	A	68	M	26-04-2022	Hemiarthroplasty	120	56	5'1"	23.3	2	alert	78	150	90	94
30	1273996	V	B	63	M	23-03-2022	Hemiarthroplasty	120	80	5'7"	27.6	3	alert	110	110	70	96
31	1262073	HS	C	69	M	02-03-2022	wound exploration left hip	80	82	5'6"	29.2	2	alert	92	150	90	98
32	1252454	TJ	A	68	F	16-02-2022	PFN	80	42	5'3"	17.6	3	alert	84	140	80	95
33	1264454	RD	A	80	F	24-02-2022	Hemiarthroplasty	120	65	5'4"	24.6	2	alert	105	120	80	99
34	1258913	TK	B	85	F	24-02-2022	PFN	90	60	5'5"	22	3	alert	84	150	90	98
35	522223	PS	A	44	M	25-02-2022	PFN	90	118	5'10"	37.3	3	alert	68	100	60	99
36	1287761	R	C	37	F	26-02-2022	femur nailing	160	80	5'11"	24.6	3	alert	99	130	80	98
37	1250701	HK	B	77	F	10-02-2022	ORIF shaft femur	150	65	5'3"	25.4	2	alert	86	130	80	98
38	923951	VJ	B	71	M	31-01-2022	PFN	90	80	5'6"	28.5	3	alert	90	130	80	96
39	1008490	IS	B	85	M	02-02-2022	OrIF shaft femur	140	85	5'7"	29.3	3	alert	89	140	90	97
40	1247934	AK	B	63	M	03-02-2022	PFN	90	86	5'5"	31.6	2	alert	96	150	90	97
41	1247920	RDS	C	85	M	03-02-2022	PFN	90	78	5'9"	25.4	1	alert	69	120	70	96
42	403103	AK	A	35	M	29-04-2021	PFN	90	78	5'5"	22	1	alert	100	110	80	100
43	1193765	SK	B	65	F	03-12-2021	PFN	100	65	5'0"	28	3	alert	84	130	80	98
44	1218868	AK	A	68	M	06-12-2021	Hemiarthroplasty	130	71	5'4"	26.9	3	alert	74	140	80	99
45	996162	KK	A	68	F	14-05-2022	PFN	90	66	5'2"	26.6	3	alert	84	112	70	98
46	1300696	R	A	62	M	10-05-2022	PFN	90	60	5'0"	25.8	3	alert	89	140	90	97
47	1291327	PW	A	65	F	22-04-2022	Hemiarthroplasty	120	78	5'0"	20.7	2	alert	82	130	80	98
48	220552	GD	A	68	F	02-04-2022	PFN	90	69	5'1"	28.7	3	alert	94	140	90	98
49	1273659	DD	A	65	F	26-Mar	PFN	90	72	5'1"	30	2	alert	99	130	80	97
50	1271641	KR	C	80	F	19-03-2022	Hemiarthroplasty	120	54	5'1"	22.5	2	alert	81	130	80	96

S. No.	MRD	Pre-operative RR	HR_0 hr	HR_1st hr	HR_2nd Hr	HR_3rd hr	HR_4th hr	HR_6th hr	HR_8th hr	HR_10th hr	HR_12th hr	HR_15th hr	HR_18th hr	HR_24th hr	SBP_0 hr	SBP_1st hr	SBP_2nd Hr	SBP_3rd hr	SBP_4th hr	SBP_6th hr	SBP_8th hr	SBP_10th hr
1	1032111	16	132	124	128	130	114	142	120	118	110	120	112	114	160	168	160	172	150	150	140	140
2	1057230	16	94	100	88	80	94	90	94	88	82	84	86	88	142	130	144	130	138	144	152	140
3	268027	18	68	74	92	94	88	86	84	82	84	85	86	82	140	140	150	150	140	130	120	13
4	1091471	16	80	94	108	91	88	86	82	91	112	86	81	83	120	130	150	140	130	130	120	130
5	1094087	16	93	94	96	97	98	99	94	95	96	93	92	91	110	120	120	110	110	120	130	120
6	1093220	16	92	91	88	95	97	104	108	97	94	90	88	91	138	140	130	140	150	160	160	150
7	3626	18	70	71	72	72	72	80	82	82	70	74	72	74	110	100	120	110	100	100	110	110
8	1037085	16	85	87	88	89	98	114	100	107	107	110	108	105	130	125	120	140	150	150	140	130
9	1125731	22	100	98	99	100	105	120	106	105	108	119	110	109	110	110	110	120	120	150	130	120
10	1010875	18	80	81	80	82	80	80	82	80	84	84	85	78	120	120	120	130	120	120	120	120
11	1131006	20	86	85	87	84	84	84	82	82	82	82	86	88	120	120	120	120	130	130	130	130
12	1016986	18	90	91	86	84	80	99	86	86	80	78	78	76	110	120	120	130	140	150	130	130
13	1140962	20	80	82	82	82	82	84	80	90	99	78	76	80	120	110	110	120	120	120	130	120
14	591665	18	88	88	88	89	90	84	88	88	89	91	90	86	140	140	140	130	140	140	150	140
15	403718	16	80	72	74	74	74	74	78	72	74	74	74	70	130	120	120	120	110	120	120	120
16	1168668	20	83	87	83	84	84	88	89	90	84	87	84	82	120	120	120	120	120	130	140	150
17	621833	16	84	86	87	88	85	82	83	85	84	99	82	80	110	120	120	120	120	120	110	120
18	1308093	16	91	92	90	90	93	89	89	85	104	84	89	90	140	130	130	130	140	140	150	150
19	1308004	16	84	85	84	88	85	84	90	99	90	91	90	84	110	100	100	110	120	120	120	130
20	1306584	16	70	76	78	84	81	82	88	89	90	91	100	84	110	120	110	100	100	110	110	120
21	1304254	20	89	88	89	84	90	95	99	112	99	94	108	89	120	130	130	130	130	140	140	170
22	1304190	20	80	82	84	85	86	80	88	89	94	102	106	90	120	120	110	130	130	140	140	140
23	126574	16	76	78	84	85	86	79	86	89	88	84	99	88	120	120	120	110	120	110	120	130
24	1302402	20	88	85	84	80	91	90	96	86	89	94	89	92	140	140	140	130	120	120	130	130
25	1300316	24	84	86	88	90	92	84	85	92	94	110	89	91	110	110	110	120	120	120	120	110
26	1209984	16	74	76	70	72	77	75	81	88	86	84	80	82	120	120	130	130	120	120	110	120
27	146719	20	84	89	88	90	89	91	110	91	93	94	96	84	110	120	120	120	130	150	140	140
28	1291797	16	84	81	83	82	85	80	89	90	96	93	89	84	130	120	110	120	120	120	120	120
29	1292069	20	85	83	80	83	84	89	99	90	91	92	97	90	130	120	130	140	140	150	160	150
30	1273996	16	81	82	84	83	82	85	86	84	87	89	111	90	110	110	130	120	130	120	120	130
31	1262073	20	84	83	81	80	93	85	91	85	86	82	87	80	140	130	120	130	140	130	130	140
32	1252454	18	88	81	84	86	87	82	90	106	110	91	99	84	130	140	140	140	140	150	150	160
33	1264454	16	86	88	89	85	89	91	92	111	112	90	91	84	110	120	120	120	130	140	110	140
34	1258913	20	85	78	76	71	86	88	91	84	96	98	81	89	130	120	130	140	140	130	140	130
35	522223	16	73	75	70	68	71	74	76	89	76	72	70	73	110	110	120	120	130	130	120	150
36	1287761	18	90	95	94	93	95	96	96	92	99	95	96	90	130	130	120	120	130	110	130	130
37	1250701	16	68	70	71	74	72	66	70	72	74	89	91	76	110	120	110	120	130	130	110	120
38	923951	16	91	90	89	88	92	95	91	90	96	92	98	91	130	120	120	130	140	130	140	130
39	1008490	16	90	91	89	84	87	86	84	82	81	101	84	86	130	120	120	130	140	130	140	140
40	1247934	20	80	84	84	89	88	86	87	89	88	101	84	86	120	130	130	140	140	140	130	140
41	1247920	20	72	73	76	68	75	69	75	60	75	85	74	76	120	110	120	110	120	130	130	110
42	403103	16	94	84	86	88	89	91	92	104	86	89	91	85	100	110	120	110	110	110	120	120
43	1193765	20	86	89	81	86	84	83	82	88	83	99	85	83	120	130	110	120	130	120	120	110
44	1218868	16	88	84	86	85	87	88	93	98	84	86	96	83	120	130	130	130	140	150	160	150
45	996162	16	76	77	70	71	74	76	88	99	86	84	101	86	110	120	120	130	120	130	130	150
46	1300696	18	84	86	90	91	93	94	89	88	86	89	90	94	130	120	130	120	120	130	120	130
47	1291327	16	82	81	88	84	85	86	88	99	84	89	98	82	110	120	130	140	130	140	140	160
48	220552	16	84	76	75	74	88	84	89	90	112	91	82	80	120	120	130	130	130	140	140	150
49	1273659	20	81	87	84	80	82	81	91	107	94	90	103	84	110	110	120	120	120	130	130	160
50	1271641	16	86	88	84	82	84	76	83	80	87	92	84	81	120	110	120	120	120	130	130	120

S. No.	MRD	SBP_12th hr	SBP_15th hr	SBP_18th hr	SBP_24th hr	DBP_0 hr	DBP_1Dt hr	DBP_2nd Hr	DBP_3rd hr	DBP_4th hr	DBP_6th hr	DBP_8th hr	DBP_10th hr	DBP_12th hr	DBP_15th hr	DBP_18th hr	DBP_24th hr	RR_0 hr	RR_1st hr	RR_2nd Hr	RR_3rd hr	RR_4th hr	RR_6th hr	RR_8th hr	RR_10th hr
1	1032111	140	130	150	140	106	90	100	90	92	84	90	90	90	70	80	80	16	16	16	16	16	16	16	16
2	1057230	136	130	138	134	68	76	66	66	74	78	78	90	76	80	74	72	14	14	14	14	14	14	14	14
3	268027	130	130	130	130	80	90	90	70	80	80	60	70	80	80	70	80	16	16	16	16	16	16	16	16
4	1091471	150	140	120	120	80	90	90	70	70	80	60	80	90	80	70	80	18	18	18	18	18	18	18	18
5	1094087	130	120	120	110	80	70	60	60	70	80	70	80	70	70	70	60	16	16	16	16	16	16	16	16
6	1093220	140	130	130	128	70	80	90	70	90	70	90	90	90	80	70	70	16	16	16	16	16	16	16	16
7	3626	120	120	120	110	60	60	60	70	70	70	80	64	80	62	72	60	18	18	18	18	18	18	18	18
8	1037085	130	120	120	110	85	76	80	90	90	90	80	70	60	80	80	70	16	16	16	16	16	16	16	16
9	1125731	130	150	110	120	70	70	70	80	70	90	70	80	70	90	70	80	16	16	16	16	16	16	16	16
10	1010875	120	120	120	120	70	70	80	70	70	80	90	70	80	80	60	80	16	16	16	16	16	16	16	16
11	1131006	120	120	130	130	70	70	80	80	90	80	90	80	80	70	70	80	16	16	16	16	16	16	16	16
12	1016986	120	120	110	110	80	80	90	70	70	90	70	70	80	80	70	70	18	18	18	18	18	18	18	18
13	1140962	110	120	120	120	70	70	70	70	70	80	70	90	70	80	70	70	20	20	20	20	20	20	20	20
14	591665	130	120	130	140	90	80	70	80	80	90	90	80	70	80	70	90	18	18	18	18	18	18	18	18
15	403718	30	130	130	120	80	70	70	80	70	80	70	80	90	80	90	80	16	16	16	16	16	16	16	16
16	1168668	140	130	130	120	70	70	80	60	80	90	80	90	80	70	70	80	20	20	20	20	20	20	20	20
17	621833	130	150	110	110	70	80	70	70	80	70	70	80	80	90	70	60	16	16	16	16	16	16	16	16
18	1308093	140	140	140	140	70	80	80	90	80	90	90	80	80	90	80	90	16	16	16	16	16	16	16	16
19	1308004	120	110	110	110	60	60	70	70	70	80	80	80	80	70	70	60	16	16	16	16	16	16	16	16
20	1306584	130	150	110	120	80	70	60	70	60	70	70	80	80	90	70	80	16	16	16	16	16	16	16	16
21	1304254	150	140	160	130	80	90	80	80	80	90	80	90	90	90	90	80	20	20	20	20	20	20	20	20
22	1304190	140	150	160	140	70	70	80	70	80	90	80	90	90	90	90	80	20	20	20	20	20	20	20	20
23	126574	130	140	160	130	80	70	80	80	80	70	70	80	80	90	90	80	16	16	16	16	16	16	16	16
24	1302402	140	140	140	130	70	90	80	80	80	70	70	80	90	80	80	70	20	20	20	20	20	20	20	20
25	1300316	130	150	110	120	80	70	80	70	80	70	80	70	90	90	70	80	24	24	24	24	24	24	24	24
26	1209984	120	130	130	120	70	80	90	80	70	80	70	80	80	80	90	80	18	18	18	18	18	18	18	18
27	146719	150	140	160	120	80	70	80	80	90	90	90	80	80	90	90	80	16	16	16	16	16	16	16	16
28	1291797	140	130	140	130	70	70	70	80	80	70	70	80	90	80	90	80	16	16	16	16	16	16	16	16
29	1292069	140	140	170	130	80	90	90	80	80	90	90	90	90	90	90	80	20	20	20	20	20	20	20	20
30	1273996	140	130	150	130	60	80	80	70	80	70	80	80	90	90	90	80	16	16	16	16	16	16	16	16
31	1262073	150	140	150	120	70	80	90	80	80	80	80	90	90	90	80	80	20	20	20	20	20	20	20	20
32	1252454	150	150	160	130	90	80	80	80	90	90	90	100	90	90	100	80	20	20	20	20	20	20	20	20
33	1264454	150	130	120	110	80	70	80	70	80	90	80	90	90	80	90	80	16	16	16	16	16	16	16	16
34	1258913	150	170	130	140	80	90	80	80	90	80	90	90	90	100	80	90	20	20	20	20	20	20	20	20
35	522223	130	130	110	110	80	80	80	70	70	80	80	90	90	80	60	70	16	16	16	16	16	16	16	16
36	1287761	120	120	130	110	90	70	80	80	80	70	90	80	70	80	80	70	18	18	18	18	18	18	18	18
37	1250701	130	140	130	110	80	60	80	70	90	80	70	80	90	90	80	60	20	20	20	20	20	20	20	20
38	923951	140	140	150	130	80	70	90	90	90	80	90	90	80	90	100	80	16	16	16	16	16	16	16	16
39	1008490	130	150	140	130	80	70	90	90	90	80	90	80	90	100	90	80	16	16	16	16	16	16	16	16
40	1247934	130	150	140	120	80	90	90	70	100	90	90	90	80	100	90	80	20	20	20	20	20	20	20	20
41	1247920	120	130	120	120	70	80	60	70	80	90	80	70	80	80	80	70	20	20	20	20	20	20	20	20
42	403103	110	110	100	110	70	80	60	60	70	80	90	80	70	60	60	70	16	16	16	16	16	16	16	16
43	1193765	130	150	130	110	80	70	80	80	90	70	80	70	90	100	90	70	16	16	16	16	16	16	16	16
44	1218868	140	140	160	130	90	70	80	80	90	90	100	90	80	90	90	80	16	16	16	16	16	16	16	16
45	996162	130	130	140	120	80	70	90	70	80	70	70	90	80	70	90	80	20	20	20	20	20	20	20	20
46	1300696	130	110	120	150	80	70	80	90	70	90	80	70	90	80	90	90	18	18	18	18	18	18	18	18
47	1291327	150	140	160	120	80	90	80	60	90	70	90	100	90	90	90	80	16	16	16	16	16	16	16	16
48	220552	170	140	140	130	80	90	80	70	80	90	80	90	100	80	90	80	16	16	16	16	16	16	16	16
49	1273659	140	140	150	120	60	90	80	70	70	90	80	90	90	80	90	80	20	20	20	20	20	20	20	20
50	1271641	130	140	130	120	60	70	70	80	80	90	80	80	90	80	90	80	16	16	16	16	16	16	16	16

S. No.	MRD	RR_12th hr	RR_15th hr	RR_18th hr	RR_24th hr	SPO2_0 hr	SPO2_1st hr	SPO2_2nd Hr	SPO2_3rd hr	SPO2_4th hr	SPO2_6th hr	SPO2_8th hr	SPO2_10th hr	SPO2_12th hr	SPO2_15th hr	SPO2_18th hr	SPO2_24th hr	NRS_0 hr	NRS_1st hr	NRS_2nd Hr	NRS_3rd hr	NRS_4th hr
1	1032111	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	2	2	3
2	1057230	14	14	14	14	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	1	2
3	268027	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	2	3	4	3
4	1091471	18	18	18	18	99	99	99	99	99	99	99	99	99	99	99	99	0	3	4	2	2
5	1094087	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	1	2
6	1093220	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	1	2	2
7	3626	18	18	18	18	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	0	2
8	1037085	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	0	0
9	1125731	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	2	2	2	2	2
10	1010875	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	0	1
11	1131006	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	0	0
12	1016986	18	18	18	18	98	98	98	98	98	98	98	98	98	98	98	98	0	2	2	3	3
13	1140962	20	20	20	20	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	0	2
14	591665	18	18	18	18	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	0	0
15	403718	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	0	0
16	1168668	20	20	20	20	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	1	1
17	621833	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	1	1
18	1308093	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	0	3	0	1
19	1308004	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	1	1	2	2
20	1306584	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	0	1	1	2
21	1304254	20	20	20	20	97	97	97	97	97	97	97	97	97	97	97	97	0	1	1	2	2
22	1304190	20	20	20	20	97	97	97	97	97	97	97	97	97	97	97	97	0	0	0	1	1
23	126574	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	0	0	1	1
24	1302402	20	20	20	20	97	97	97	97	97	97	97	97	97	97	97	97	0	0	0	1	3
25	1300316	24	24	24	24	97	97	97	97	97	97	97	97	97	97	97	97	0	0	0	1	1
26	1209984	18	18	18	18	97	97	97	97	97	97	97	97	97	97	97	97	0	2	1	1	1
27	146719	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	1	1	2	2
28	1291797	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	0	0	1	1
29	1292069	20	20	20	20	97	97	97	97	97	97	97	97	97	97	97	97	0	1	1	2	3
30	1273996	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	0	0	1	2
31	1262073	20	20	20	20	96	96	96	96	96	96	96	96	96	96	96	96	0	0	0	1	3
32	1252454	20	20	20	20	94	94	94	94	94	94	94	94	94	94	94	94	0	1	1	2	2
33	1264454	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	1	1	2	2
34	1258913	20	20	20	20	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	1	1
35	522223	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	1	2
36	1287761	18	18	18	18	99	99	99	99	99	99	99	99	99	99	99	99	0	0	1	1	2
37	1250701	20	20	20	20	98	98	98	98	98	98	98	98	98	98	98	98	0	0	0	0	1
38	923951	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	0	0	0	1	1
39	1008490	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	0	1	1	1
40	1247934	20	20	20	20	97	97	97	97	97	97	97	97	97	97	97	97	0	0	1	2	1
41	1247920	20	20	20	20	99	99	99	99	99	99	99	99	99	99	99	99	0	2	0	1	1
42	403103	16	16	16	16	100	100	100	100	100	100	100	100	100	100	100	100	0	1	1	2	2
43	1193765	16	16	16	16	98	98	98	98	98	98	98	98	98	98	98	98	0	0	1	1	1
44	1218868	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	1	1	1	2
45	996162	20	20	20	20	97	97	97	97	97	97	97	97	97	97	97	97	0	1	1	2	2
46	1300696	18	18	18	18	96	96	96	96	96	96	96	96	96	96	96	96	0	0	1	1	2
47	1291327	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	0	1	1	2
48	220552	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	0	1	1	2
49	1273659	20	20	20	20	97	97	97	97	97	97	97	97	97	97	97	97	0	0	0	1	2
50	1271641	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	0	0	0	1	1

S. No.	MRD	NRS_6th hr	NRS_8th hr	NRS_10th hr	NRS_12th hr	NRS_15th hr	NRS_18th hr	NRS_24th hr	Time to request of first analgesia (in mins)	Total Tramadol (in mg)	Total Fentanyl (in mcg)	At 3 hours	At 6 Hours	At 12 Hours	At 24 Hours	Cumulative Analgesic Consumption (of tramadol in mg)	Pt satisfaction	Side effects
1	1032111	4	2	2	3	2	2	3	420	50	-	-	-	50	50	100	satisfied	none
2	1057230	2	3	3	2	2	1	2	-	-	-	-	-	-	-	-	very satisfied	none
3	268027	2	2	1	2	1	2	2	240	50	-	-	50	50	50	150	satisfied	none
4	1091471	1	2	3	4	3	2	2	180	100	-	-	50	50	100	200	satisfied	none
5	1094087	2	1	2	3	3	2	2	-	-	-	-	-	-	-	-	very satisfied	none
6	1093220	4	4	3	2	2	1	1	510	100	-	-	-	50	100	150	satisfied	none
7	3626	5	0	0	0	0	2	2	420	50	-	-	-	50	50	100	satisfied	none
8	1037085	2	0	0	0	0	0	0	-	-	-	-	-	-	-	-	very satisfied	none
9	1125731	5	2	1	1	3	4	1	360	100	-	-	50	50	100	200	satisfied	none
10	1010875	1	1	2	2	1	0	2	-	-	-	-	-	-	-	-	very satisfied	none
11	1131006	0	1	1	1	2	2	3	-	-	-	-	-	-	-	-	very satisfied	none
12	1016986	7	2	2	1	1	1	0	360	50	-	-	50	50	50	150	satisfied	none
13	1140962	2	3	6	0	2	0	1	660	50	-	-	-	50	50	100	satisfied	none
14	591665	0	2	2	1	2	1	1	-	-	-	-	-	-	-	-	very satisfied	none
15	403718	0	0	0	0	0	1	1	-	-	-	-	-	-	-	-	very satisfied	none
16	1168668	2	3	5	2	1	1	1	540	50	-	-	-	50	50	100	satisfied	none
17	621833	2	2	2	3	4	0	1	900	50	-	-	-	-	50	50	satisfied	none
18	1308093	1	2	2	3	4	1	1	935	50	-	-	-	-	50	50	satisfied	none
19	1308004	3	3	4	2	2	1	1	600	50	-	-	-	50	50	100	satisfied	none
20	1306584	2	3	3	3	3	4	1	1080	50	-	-	-	-	50	50	satisfied	none
21	1304254	2	3	4	3	3	4	2	600	100	-	-	-	50	100	150	neither sat/dis	none
22	1304190	2	2	3	3	3	4	2	1080	50	-	-	-	-	50	50	satisfied	none
23	126574	1	2	2	3	3	4	2	1080	50	-	-	-	-	50	50	satisfied	none
24	1302402	1	2	2	3	4	2	3	910	50	-	-	-	-	50	50	satisfied	none
25	1300316	2	2	3	3	4	3	2	900	50	-	-	-	-	50	50	neither sat/dis	none
26	1209984	2	1	3	3	4	2	2	920	50	-	-	-	-	50	50	satisfied	none
27	146719	3	4	4	3	3	4	2	500	100	-	-	-	50	100	150	neither sat/dis	none
28	1291797	2	2	3	3	4	3	2	900	50	-	-	-	-	50	50	satisfied	none
29	1292069	3	4	3	3	2	4	1	480	100	-	-	-	50	100	150	neither sat/dis	none
30	1273996	1	2	2	3	3	4	3	1150	50	-	-	-	-	50	50	satisfied	none
31	1262073	2	1	1	2	1	0	1	-	-	-	-	-	-	-	-	very satisfied	none
32	1252454	3	3	4	3	3	4	2	530	100	-	-	-	50	100	150	neither sat/dis	none
33	1264454	3	3	4	4	2	1	1	670	50	-	-	-	50	50	100	satisfied	none
34	1258913	1	2	2	3	4	2	1	860	50	-	-	-	-	50	50	satisfied	none
35	522223	2	3	4	2	2	1	1	520	50	-	-	-	50	50	100	neither sat/dis	none
36	1287761	3	2	2	2	1	0	0	-	-	-	-	-	-	-	-	very satisfied	none
37	1250701	1	2	2	3	4	4	1	1050	50	-	-	-	-	50	50	satisfied	none
38	923951	2	2	3	3	3	4	1	1120	50	-	-	-	-	50	50	satisfied	none
39	1008490	2	2	3	3	4	2	1	950	50	-	-	-	-	50	50	satisfied	none
40	1247934	1	2	2	3	4	2	1	840	50	-	-	-	-	50	50	satisfied	none
41	1247920	2	1	2	3	4	2	1	950	50	-	-	-	-	50	50	satisfied	none
42	403103	3	3	4	3	2	2	1	660	50	-	-	-	50	50	100	neither sat/dis	none
43	1193765	2	2	3	3	4	3	2	970	50	-	-	-	-	50	50	satisfied	none
44	1218868	3	4	4	3	3	4	2	520	100	-	-	-	50	100	150	neither sat/dis	none
45	996162	2	3	4	3	2	4	2	600	100	-	-	-	50	100	150	neither sat/dis	none
46	1300696	2	3	2	2	3	3	4	1200	50	-	-	-	-	50	50	satisfied	none
47	1291327	2	3	4	3	3	4	2	540	100	-	-	-	50	100	150	neither sat/dis	none
48	220552	2	3	3	4	3	2	2	650	50	-	-	-	-	50	50	satisfied	none
49	1273659	2	3	4	3	3	4	1	500	100	-	-	-	50	100	150	neither sat/dis	none
50	1271641	2	2	2	3	4	2	1	940	50	-	-	-	-	50	50	satisfied	none

S. No.	MRD	INTIALS	Group	Age	Sex	Date of Sx	Type of Sx	Duration of Sx (in mins)	Weight (Kg)	Height	BMI (kg/m2)	ASA grade	consciousness	Pre-operative HR	Pre-operative SBP	Pre-operative DBP	Pre-operative SpO2
51	1263245	VK	C	72	M	04-03-2022	PFN	90	75	5'10"	23.7	1	alert	94	140	80	95
52	332347	DW	B	79	F	22-02-2022	PFN	90	56	5'0"	24.1	3	alert	68	120	80	98
53	1332470	RR	C	59	F	30-06-2022	PFN	90	52	5'2"	21	2	alert	76	128	80	93
54	149623	RG	A	52	F	02-07-2022	Hemiarthroplasty	120	53	5'0"	22.8	3	alert	89	150	90	98
55	1331860	RS	C	70	M	02-07-2022	Hemiarthroplasty	90	60	5'6"	21.3	1	alert	73	110	80	97
56	991854	BMD	C	81	M	17-06-2022	Hemiarthroplasty	90	78	5'7"	26.9	1	alert	66	110	70	94
57	1325963	MR	C	31	M	20-06-2022	femur nailing	110	60	5'6"	21.3	3	alert	63	100	60	99
58	1327812	SS	C	86	F	23-06-2022	PFN	90	56	5'0"	24.1	2	alert	101	140	90	96
59	1330236	MK	A	61	F	28-06-2022	Hemiarthroplasty	110	55	5'2"	22.2	3	alert	82	150	90	99
60	552346	AK	C	36	F	27-05-2022	femur implant removal	60	43	5'5"	15.8	3	alert	73	110	70	99
61	1324373	JS	A	72	M	16-06-2022	Hemiarthroplasty	90	67	5'2"	27	3	alert	89	150	90	96
62	962254	JS	C	32	M	20-06-2022	femur implant removal	80	88	5'8"	28.5	3	alert	88	120	80	98
63	1325992	UR	A	63	F	21-06-2022	femur plating	135	98	5'7"	34.5	3	alert	81	190	90	93
64	1329838	J	A	63	M	27-06-2022	PFN	100	78	5'8"	26.1	3	alert	82	150	90	97
65	1330269	NR	A	55	F	28-06-2022	PFN	110	78	5'0"	20.7	2	alert	80	120	80	98
66	1331757	PL	C	55	F	29-06-2022	femur nailing	140	68	5'4"	25.7	2	alert	85	130	70	97
67	1335301	MS	C	53	M	05-07-2022	femur nailing	120	75	5'9"	24.4	3	alert	76	140	90	99
68	1125637	SK	A	72	F	20-08-2021	PFN	90	63	5'3"	24.6	3	alert	99	150	90	97
69	538338	YS	C	32	M	24-06-2021	femur implant removal	60	80	6'1"	23.3	3	alert	93	116	80	99
70	1232558	SS	A	80	M	03-01-2022	femur nailing	130	68	5'7"	23.5	3	alert	84	160	90	97
71	1233700	YD	A	79	F	05-01-2022	PFN	90	72	4'10"	24	3	alert	101	150	90	96
72	1236217	NS	C	72	M	08-01-2022	Hemiarthroplasty	90	65	5'3"	25.4	2	alert	92	150	90	97
73	1238346	AK	C	74	F	13-01-2022	PFN	90	66	5'1"	27.5	2	alert	99	140	90	97
74	1335701	UR	A	75	F	07-07-2022	Hemiarthroplasty	120	68	5'4"	25.7	2	alert	89	150	90	97
75	1336620	T	A	60	M	09-07-2022	Hemiarthroplasty	110	63	5'0"	27.1	2	alert	93	140	90	97
76	677409	RKM	C	72	M	09-07-2022	PFN	90	75	5'6"	26.7	2	alert	92	150	90	97
77	1338887	GS	C	56	M	12-07-2022	femur nailing	110	84	5'9"	27.3	3	alert	87	140	90	99
78	1338790	BM	A	61	M	12-07-2022	Hemiarthroplasty	100	70	5'4"	26.5	3	alert	86	160	100	97
79	1339361	KR	A	70	F	14-07-2022	PFN	90	72	5'1"	21.7	3	alert	80	150	90	96
80	1341348	NS	A	80	M	14-07-2022	Hemiarthroplasty	90	76	5'9"	24.7	2	alert	74	140	90	95
81	1341526	DK	C	55	M	15-07-2022	femur nailing	120	84	5'11"	25.8	3	alert	94	140	90	99
82	1342882	KS	A	70	M	19-07-2022	PFN	90	88	5'0"	20.7	3	alert	86	150	90	96
83	1344920	GR	C	65	F	21-07-2022	Hemiarthroplasty	120	81	5'8"	27.2	2	alert	94	140	90	97
84	1345111	JK	A	72	F	25-07-2022	Hemiarthroplasty	150	73	5'4"	27.6	3	alert	80	130	90	99
85	1347158	HS	C	33	M	26-07-2022	ORIF Femur Right	120	80	5'7"	27.6	3	alert	91	126	80	99
86	45342	PK	A	72	F	26-07-2022	PFN	90	61	5'3"	23.8	2	alert	76	140	90	99
87	127746	SB	C	72	M	26-07-2022	PFN	100	65	5'7"	22.4	3	alert	85	138	76	98
88	568591	SK	C	28	F	26-07-2022	femur nailing	130	70	5'5"	25.7	3	alert	97	130	90	100
89	1353111	MK	C	38	M	03-08-2022	femur nailing	130	83	5'10"	26.3	3	alert	96	150	90	100
90	1055820	TC	C	67	F	03-08-2022	PFN	100	89	5'6"	31.7	2	alert	93	140	90	97

S. No.	MRD	Pre-operative RR	HR_0 hr	HR_1st hr	HR_2nd Hr	HR_3rd hr	HR_4th hr	HR_6th hr	HR_8th hr	HR_10th hr	HR_12th hr	HR_15th hr	HR_18th hr	HR_24th hr	SBP_0 hr	SBP_1st hr	SBP_2nd Hr	SBP_3rd hr	SBP_4th hr	SBP_6th hr	SBP_8th hr	SBP_10th hr
51	1263245	20	90	84	86	87	92	90	96	92	98	93	84	86	140	130	130	140	140	140	150	130
52	332347	16	84	86	88	90	92	85	111	94	107	92	90	89	120	130	130	140	140	140	160	150
53	1332470	20	81	80	76	86	83	78	84	84	88	80	81	88	100	110	120	130	130	140	130	120
54	149623	16	89	88	91	90	91	93	111	96	90	114	90	88	130	140	140	140	150	150	170	150
55	1331860	20	70	74	76	72	90	79	85	81	89	92	76	77	100	110	110	120	130	140	130	140
56	991854	18	76	74	73	70	73	68	76	66	73	82	69	74	100	110	120	110	120	120	120	110
57	1325963	16	83	76	77	78	83	74	81	75	83	89	80	82	100	100	110	110	120	120	110	100
58	1327812	16	101	98	96	92	94	93	101	90	96	94	96	92	120	110	120	130	140	130	140	140
59	1330236	16	85	89	88	91	93	94	96	101	96	99	90	91	120	130	140	150	150	150	160	160
60	552346	16	70	71	73	70	78	76	86	70	77	86	74	76	100	90	110	120	120	120	110	100
61	1324373	20	89	84	88	86	87	85	89	93	99	121	88	89	130	140	140	150	140	140	130	140
62	962254	16	88	86	80	82	92	89	99	84	88	86	88	91	110	100	110	110	120	110	110	110
63	1325992	20	83	86	89	91	90	99	101	95	89	91	94	92	140	150	150	160	160	180	170	160
64	1329838	16	80	86	89	94	91	90	99	84	86	98	85	80	130	140	150	150	140	150	150	170
65	1330269	14	82	80	78	76	72	76	79	101	89	91	84	80	100	110	110	120	110	120	130	150
66	1331757	16	72	69	70	74	80	77	75	71	79	70	69	68	100	110	120	110	120	110	100	110
67	1335301	14	80	81	83	74	83	76	84	72	79	85	77	81	120	110	130	140	150	140	130	140
68	1125637	16	91	89	96	94	92	93	94	107	94	95	116	99	120	110	130	140	150	140	140	150
69	538338	20	86	88	93	94	94	91	101	94	103	91	99	93	110	120	110	120	130	140	130	140
70	1232558	16	76	81	83	89	91	96	99	107	94	96	102	86	120	120	130	130	140	150	150	160
71	1233700	20	81	83	90	86	88	87	112	94	91	109	90	84	120	130	140	130	140	150	170	150
72	1236217	16	84	81	80	86	92	91	95	88	89	96	87	88	110	110	120	120	130	120	140	130
73	1238346	18	90	91	94	95	98	93	104	92	96	96	95	94	110	110	120	120	130	130	140	130
74	1335701	18	86	82	83	81	85	86	101	88	86	97	99	84	130	140	130	140	140	150	170	140
75	1336620	18	86	88	90	89	96	97	111	91	84	103	88	82	130	140	130	140	140	150	160	150
76	677409	16	91	88	84	82	84	81	93	89	96	93	90	91	120	130	140	140	130	140	130	130
77	1338887	16	84	86	88	90	95	93	95	89	93	94	85	87	130	140	130	140	130	120	130	130
78	1338790	20	86	91	88	89	85	87	101	113	91	93	106	84	120	130	140	140	150	150	160	170
79	1339361	18	78	76	83	88	91	94	101	99	96	103	81	79	130	120	130	140	140	150	170	150
80	1341348	16	78	76	75	73	90	94	106	89	93	104	94	86	120	130	140	150	140	150	160	150
81	1341526	16	81	88	86	85	83	78	77	84	86	91	89	76	120	120	130	110	120	110	120	130
82	1342882	20	81	86	91	92	96	95	101	91	93	89	115	79	130	120	130	140	130	140	160	150
83	1344920	18	78	81	80	86	89	88	85	81	89	89	91	82	130	130	120	130	140	130	140	130
84	1345111	18	76	81	88	89	91	89	96	84	82	108	89	78	120	120	130	140	130	140	160	150
85	1347158	16	80	81	74	75	75	88	78	81	81	84	79	82	120	110	120	110	120	130	110	120
86	45342	20	71	76	79	83	86	98	86	88	101	89	74	76	130	140	140	150	140	160	150	150
87	127746	20	70	72	68	69	80	75	82	89	86	86	79	71	120	110	130	120	130	130	140	150
88	568591	16	81	83	91	96	90	93	92	88	102	89	92	90	100	100	110	100	110	120	130	100
89	1353111	16	91	88	92	85	88	93	91	94	93	86	87	91	120	130	130	120	120	130	130	140
90	1055820	20	86	74	71	80	80	74	89	79	90	79	87	91	130	140	130	150	140	150	140	130

S. No.	MRD	SBP_12th hr	SBP_15th hr	SBP_18th hr	SBP_24th hr	DBP_0 hr	DBP_1Dt hr	DBP_2nd Hr	DBP_3rd hr	DBP_4th hr	DBP_6th hr	DBP_8th hr	DBP_10th hr	DBP_12th hr	DBP_15th hr	DBP_18th hr	DBP_24th hr	RR_0 hr	RR_1st hr	RR_2nd Hr	RR_3rd hr	RR_4th hr	RR_6th hr	RR_8th hr	RR_10th hr
51	1263245	140	130	140	120	80	90	90	90	100	70	90	80	80	90	80	70	20	20	20	20	20	20	20	20
52	332347	170	140	130	130	80	90	90	80	80	90	100	90	100	90	80	70	20	20	20	20	20	20	20	20
53	1332470	120	110	120	130	60	80	70	60	80	90	70	60	80	70	80	70	20	20	20	20	20	20	20	20
54	149623	140	160	140	130	90	80	100	80	90	80	100	90	90	90	80	70	16	16	16	16	16	16	16	16
55	1331860	140	120	120	130	70	60	60	60	80	90	90	90	90	80	80	90	20	20	20	20	20	20	20	20
56	991854	100	110	100	110	60	70	60	60	60	70	60	70	80	70	60	70	18	18	18	18	18	18	18	18
57	1325963	100	110	120	120	60	70	60	60	80	70	70	60	70	70	80	80	16	16	16	16	16	16	16	16
58	1327812	140	130	120	120	70	70	80	80	90	70	80	90	90	90	80	70	16	16	16	16	16	16	16	16
59	1330236	150	150	140	130	90	90	100	80	90	90	100	110	90	90	90	80	16	16	16	16	16	16	16	16
60	552346	100	110	120	120	60	70	80	60	60	70	70	60	70	70	70	70	16	16	16	16	16	16	16	16
61	1324373	150	160	140	140	90	80	90	90	80	90	70	90	90	100	90	90	20	20	20	20	20	20	20	20
62	962254	110	120	110	110	60	60	70	70	70	80	70	80	60	80	70	60	16	16	16	16	16	16	16	16
63	1325992	150	150	140	140	90	90	90	90	100	100	90	90	90	90	80	90	20	20	20	20	20	20	20	20
64	1329838	160	160	150	150	90	90	90	80	90	90	90	100	90	100	90	90	16	16	16	16	16	16	16	16
65	1330269	130	120	110	110	70	60	80	60	70	80	80	90	80	80	70	60	14	14	14	14	14	14	14	14
66	1331757	120	120	110	120	70	80	60	60	70	70	60	70	80	60	70	70	16	16	16	16	16	16	16	16
67	1335301	130	130	130	130	70	80	90	70	90	80	90	90	80	80	80	90	14	14	14	14	14	14	14	14
68	1125637	150	140	160	140	70	80	90	60	90	90	90	90	90	90	100	90	16	16	16	16	16	16	16	16
69	538338	140	130	120	120	70	80	80	70	90	90	80	90	80	90	80	70	16	16	16	16	16	16	16	16
70	1232558	140	150	150	130	80	90	80	60	90	90	90	90	90	90	90	80	16	16	16	16	16	16	16	16
71	1233700	150	160	140	140	90	90	80	60	80	90	100	90	90	90	90	90	20	20	20	20	20	20	20	20
72	1236217	120	130	120	130	60	80	90	70	80	90	80	90	70	90	70	90	16	16	16	16	16	16	16	16
73	1238346	120	110	120	120	70	80	80	70	70	90	90	90	70	70	7	80	16	16	16	16	16	16	16	16
74	1335701	140	150	160	140	90	90	90	90	90	90	90	90	90	90	90	90	18	18	18	18	18	18	18	18
75	1336620	140	160	140	130	90	80	90	80	100	90	100	90	90	100	90	80	18	18	18	18	18	18	18	18
76	677409	140	140	130	120	80	90	90	70	80	90	80	90	100	90	80	80	16	16	16	16	16	16	16	16
77	1338887	140	130	120	130	90	90	100	80	80	70	80	90	90	80	80	90	16	16	16	16	16	16	16	16
78	1338790	150	140	160	140	90	90	80	9	8	90	90	100	90	90	90	90	20	20	20	20	20	20	20	20
79	1339361	150	160	140	130	80	90	90	90	80	90	100	90	80	90	80	90	18	18	18	18	18	18	18	18
80	1341348	150	170	140	130	80	90	90	70	80	100	90	100	90	90	90	80	16	16	16	16	16	16	16	16
81	1341526	130	120	110	110	80	90	70	80	80	80	70	90	80	80	70	60	16	16	16	16	16	16	16	16
82	1342882	140	140	170	130	80	90	90	80	80	90	90	90	90	90	100	90	20	20	20	20	20	20	20	20
83	1344920	140	140	150	140	80	70	90	90	90	80	90	90	80	90	90	80	18	18	18	18	18	18	18	18
84	1345111	130	170	130	120	80	90	90	70	80	90	90	90	80	90	80	70	18	18	18	18	18	18	18	18
85	1347158	130	120	110	110	70	60	80	80	80	90	70	80	90	70	60	70	16	16	16	16	16	16	16	16
86	45342	170	150	140	140	90	80	90	70	80	90	80	90	100	90	80	90	20	20	20	20	20	20	20	20
87	127746	130	120	120	130	60	80	80	70	90	60	80	90	80	70	80	90	20	20	20	20	20	20	20	20
88	568591	120	100	110	120	70	70	60	60	70	80	70	60	80	70	70	80	16	16	16	16	16	16	16	16
89	1353111	130	170	120	110	80	90	60	70	70	80	90	90	70	80	70	70	16	16	16	16	16	16	16	16
90	1055820	140	150	130	140	90	80	90	70	80	90	70	80	80	90	70	90	20	20	20	20	20	20	20	20

S. No.	MRD	RR_12th hr	RR_15th hr	RR_18th hr	RR_24th hr	SPO2_0 hr	SPO2_1st hr	SPO2_2nd Hr	SPO2_3rd hr	SPO2_4th hr	SPO2_6th hr	SPO2_8th hr	SPO2_10th hr	SPO2_12th hr	SPO2_15th hr	SPO2_18th hr	SPO2_24th hr	NRS_0 hr	NRS_1st hr	NRS_2nd Hr	NRS_3rd hr	NRS_4th hr
51	1263245	20	20	20	20	95	95	95	95	95	95	95	95	95	95	95	95	0	0	0	0	1
52	332347	20	20	20	20	98	98	98	98	98	98	98	98	98	98	98	98	1	1	2	2	3
53	1332470	20	20	20	20	94	94	94	94	94	94	94	94	94	94	94	94	0	1	0	1	1
54	149623	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	1	1	2	3
55	1331860	20	20	20	20	96	96	96	96	96	96	96	96	96	96	96	96	0	0	0	1	1
56	991854	18	18	18	18	94	94	94	94	94	94	94	94	94	94	94	94	0	1	2	1	0
57	1325963	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	0	0
58	1327812	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	0	1	0	0	1
59	1330236	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	0	1	1	2	2
60	552346	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	1	1
61	1324373	20	20	20	20	95	95	95	95	95	95	95	95	95	95	95	95	0	0	0	0	0
62	962254	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	2	1	1
63	1325992	20	20	20	20	92	92	92	92	92	92	92	92	92	92	92	92	0	1	2	3	3
64	1329838	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	0	1	1	2	2
65	1330269	14	14	14	14	97	97	97	97	97	97	97	97	97	97	97	97	0	0	1	1	2
66	1331757	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	2	0	0	1
67	1335301	14	14	14	14	99	99	99	99	99	99	99	99	99	99	99	99	0	0	1	1	1
68	1125637	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	0	1	2	2	2
69	538338	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	0	2
70	1232558	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	0	1	1	2	2
71	1233700	20	20	20	20	95	95	95	95	95	95	95	95	95	95	95	95	0	1	2	2	3
72	1236217	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	0	0	0	0	2
73	1238346	16	16	16	16	96	96	97	97	97	97	97	97	97	97	97	97	0	0	2	0	1
74	1335701	18	18	18	18	96	96	96	96	96	96	96	96	96	96	96	96	0	1	1	2	2
75	1336620	18	18	18	18	96	96	96	96	96	96	96	96	96	96	96	96	0	1	2	2	3
76	677409	16	16	16	16	97	97	97	97	97	97	97	97	97	97	97	97	0	0	0	1	1
77	1338887	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	1	1
78	1338790	20	20	20	20	95	95	95	95	95	95	95	95	95	95	95	95	0	1	2	2	3
79	1339361	18	18	18	18	96	96	96	96	96	96	96	96	96	96	96	96	0	1	2	2	3
80	1341348	16	16	16	16	96	96	96	96	96	96	96	96	96	96	96	96	1	2	2	2	3
81	1341526	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	3	1	2
82	1342882	20	20	20	20	96	96	96	96	96	96	96	96	96	96	96	96	0	1	2	2	3
83	1344920	18	18	18	18	97	97	97	97	97	97	97	97	97	97	97	97	0	2	0	1	1
84	1345111	18	18	18	18	98	98	98	98	98	98	98	98	98	98	98	98	0	1	2	3	2
85	1347158	16	16	16	16	99	99	99	99	99	99	99	99	99	99	99	99	0	0	0	1	1
86	45342	20	20	20	20	98	98	98	98	98	98	98	98	98	98	98	98	0	2	2	3	3
87	127746	20	20	20	20	98	98	98	98	98	98	98	98	98	98	98	98	0	0	1	0	2
88	568591	16	16	16	16	100	100	100	100	100	100	100	100	100	100	100	100	0	0	2	1	2
89	1353111	16	16	16	16	100	100	100	100	100	100	100	100	100	100	100	100	0	0	2	1	2
90	1055820	20	20	20	20	97	97	97	97	97	97	97	97	97	97	97	97	0	0	1	1	2

S. No.	MRD	NRS_6th hr	NRS_8th hr	NRS_10th hr	NRS_12th hr	NRS_15th hr	NRS_18th hr	NRS_24th hr	Time to request of first analgesia (in mins)	Total Tramadol (in mg)	Total Fentanyl (in mcg)	At 3 hours	At 6 Hours	At 12 Hours	At 24 Hours	Cumulative Analgesic Consumption (of tramadol in mg)	Pt satisfaction	Side effects
51	1263245	1	2	2	3	4	1	0	900	50	-	-	-	-	50	50	satisfied	none
52	332347	3	4	3	4	3	2	1	480	100	-	-	-	50	100	150	neither sat/dis	none
53	1332470	2	1	1	2	1	0	1	-	-	-	-	-	-	-	-	very satisfied	none
54	149623	3	6	2	2	6	0	1	500	100	-	-	-	50	100	150	neither sat/dis	none
55	1331860	2	3	2	2	1	1	1	-	-	-	-	-	-	-	-	very satisfied	none
56	991854	1	2	2	2	1	2	1	-	-	-	-	-	-	-	-	very satisfied	none
57	1325963	1	1	3	3	4	1	1	960	50	-	-	-	-	50	50	satisfied	none
58	1327812	1	1	2	2	4	2	1	990	50	-	-	-	-	50	50	neither sat/dis	none
59	1330236	3	3	6	3	4	3	2	610	100	-	-	-	50	100	150	neither sat/dis	none
60	552346	2	1	2	3	4	1	0	920	50	-	-	-	-	50	50	satisfied	none
61	1324373	1	1	2	3	6	1	1	810	50	-	-	-	-	50	50	satisfied	none
62	962254	2	1	1	2	0	1	2	-	-	-	-	-	-	-	-	very satisfied	none
63	1325992	4	3	2	2	2	3	2	530	50	-	-	-	50	50	100	neither sat/dis	none
64	1329838	3	6	3	3	5	2	1	550	100	-	-	-	50	100	150	neither sat/dis	none
65	1330269	3	3	4	3	3	2	1	630	50	-	-	-	50	50	100	neither sat/dis	none
66	1331757	1	2	1	2	4	2	2	990	50	-	-	-	-	50	50	satisfied	none
67	1335301	2	1	3	3	4	2	2	900	50	-	-	-	-	50	50	satisfied	none
68	1125637	3	3	6	3	3	6	2	580	100	-	-	-	50	100	150	neither sat/dis	none
69	538338	1	1	2	2	4	2	2	930	50	-	-	-	-	50	50	satisfied	none
70	1232558	3	3	6	3	3	5	2	615	100	-	-	-	50	100	150	neither sat/dis	none
71	1233700	3	6	3	3	5	2	1	500	100	-	-	-	50	100	150	neither sat/dis	none
72	1236217	1	1	2	2	1	1	2	-	-	-	-	-	-	-	-	very satisfied	none
73	1238346	1	2	1	2	2	2	1	-	-	-	-	-	-	-	-	very satisfied	none
74	1335701	3	4	3	2	2	4	1	490	100	-	-	-	50	100	150	neither sat/dis	none
75	1336620	3	6	3	3	5	2	1	490	100	-	-	-	50	100	150	neither sat/dis	none
76	677409	2	2	1	2	4	2	1	960	50	-	-	-	-	50	50	satisfied	none
77	1338887	2	2	3	3	4	1	1	950	50	-	-	-	-	50	50	satisfied	none
78	1338790	3	4	5	3	3	5	2	540	100	-	-	-	50	100	150	neither sat/dis	none
79	1339361	3	6	3	3	6	3	2	490	100	-	-	-	50	100	150	neither sat/dis	none
80	1341348	3	6	3	3	6	2	1	500	100	-	-	-	50	100	150	neither sat/dis	none
81	1341526	1	1	2	2	4	1	1	900	50	-	-	-	-	50	50	satisfied	none
82	1342882	3	4	3	3	2	6	2	530	100	-	-	-	50	100	150	neither sat/dis	none
83	1344920	2	1	2	1	2	3	2	-	-	-	-	-	-	-	-	very satisfied	none
84	1345111	3	4	3	2	6	3	2	505	100	-	-	-	50	100	150	neither sat/dis	none
85	1347158	2	1	2	1	4	2	1	980	50	-	-	-	-	50	50	Satisfied	none
86	45342	4	3	3	6	3	2	2	495	100	-	-	-	50	100	150	neither sat/dis	none
87	127746	1	2	3	1	1	1	2	-	-	-	-	-	-	-	-	very satisfied	none
88	568591	2	2	1	1	1	1	2	-	-	-	-	-	-	-	-	very satisfied	none
89	1353111	2	1	1	1	2	2	2	-	-	-	-	-	-	-	-	very satisfied	none
90	1055820	1	2	2	2	2	2	1	-	-	-	-	-	-	-	-	very satisfied	none

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The Principal,
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Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.10.2021 has approved the plan of thesis of **Jessica Sekhon**, a student of your college for **MD Anaesthesiology** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis

Efficacy of different volumes of 0.2% ropivacaine in suprainguinal fascia iliaca compartment block for multimodal analgesia in lower limb surgery.

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The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

S P Singh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

17. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
18. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERIES

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF MEDICINE

In

ANAESTHESIOLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

MARCH 2021

Dr. Jessica Sekhon

DEPARTMENT OF ANAESTHESIOLOGY
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ABSTRACT OF PLAN OF THESIS

Title	EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERY
For the degree of	M.D. Anaesthesia
Name of the candidate	Dr. Jessica Sekhon
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Co-supervisor	Dr. Neeru Luthra, Associate Professor, Department of Anaesthesiology, DMCH, Ludhiana Dr. Pankaj Mohindra, Associate Professor, Department of Orthopaedics, DMCH, Ludhiana
Institution	Dayanand Medical College and Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Conventional analgesics used as a part of multimodal analgesia after lower limb surgeries, such as non-steroidal anti-inflammatory drugs and opioids, are associated with side effects. Newer regional anaesthesia modalities like suprainguinal fascia iliaca compartment block reduce these side effects in addition to providing adequate analgesia in the post operative period.

Aim of Study: To compare the efficacy of different volumes of 0.2% ropivacaine used in suprainguinal fascia iliaca compartment for pain management in lower limb surgery.

Materials & methods: A prospective, double blind, randomized study will be conducted on 90 adult patients of ASA I, II and III undergoing lower limb surgeries who will randomly be divided into 3 groups- A, B and C to receive either 20 ml , 30 ml or 40 ml 0.2% ropivacaine respectively in an ultrasound guided suprainguinal fascia iliaca compartment block which will be performed after subarachnoid block, by an experienced anaesthesiologist. The time to first request of rescue analgesia as primary outcome measures will be recorded, with the secondary outcome variables being total requirement of analgesics for pain management and patient satisfaction score. Data thus collected will be statistically analyzed.

Clinical Significance: This study will focus on evaluating the efficacy of different volumes of 0.2% ropivacaine in suprainguinal fascia iliaca compartment block for multimodal analgesia in lower limb surgeries.

Keywords: Suprainguinal fascia iliaca compartment block, Femoral nerve, Obturator nerve, Lateral cutaneous nerve of thigh, Multimodal analgesia, Post-operative analgesia.

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERIES"** exist in the Department of Anaesthesiology at Dayanand Medical College and Hospital, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate herself under our supervision and guidance.

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APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
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BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

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3.	COURSE OF STUDY AND SUBJECT	M.D. ANAESTHESIOLOGY
4.	DATE OF ADMISSION OF COURSE	25th JULY, 2020
5.	TITLE OF THE TOPIC	EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERIES

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Conventional analgesics used as a part of multimodal analgesia after lower limb surgeries, such as non-steroidal anti-inflammatory drugs and opioids, are associated with side effects like nausea, vomiting, drowsiness, urinary retention and constipation, cough suppression and respiratory depression. The fascia iliaca compartment block (FICB) is a regional anaesthesia technique where local anaesthetic is deposited in fascial plane below the fascia iliaca and above the iliacus muscle in the fascia iliaca region. The fascia iliaca compartment block (FICB) was first described by Dalens and colleagues in 1989.[1] Indications for a FICB include surgical anaesthesia to the lower extremity after knee, femoral shaft, hip surgery, management of cancer pain or pain secondary to inflammatory conditions of the lumbar plexus, as well as treatment of acute pain in the setting of trauma, fracture, or burns. The FICB is commonly administered in children for anterolateral thigh surgery.[2] The FICB may be performed using either a loss of resistance technique or an ultrasound (US)-guided technique. The main targets of the FICB are the predominant nerves contained in the fascia iliaca compartment (FIC), namely the femoral nerve(FN) and the lateral femoral cutaneous nerve(LFCN).[3] The femoral and obturator nerves(ON) innervate the hip joint capsule, with the main nerve supply being from the obturator nerve.[4] This block is an anterior approach to the lumbar plexus, where local anaesthetic is injected proximally beneath the fascia iliaca, above the inguinal ligament with the aim of blocking the femoral nerve(FN), the lateral femoral cutaneous nerve of thigh(LFCN), and the obturator nerve(ON) at its origin at the level of lumbar plexus. Thus anaesthetizing the anterior and medial thigh, including the knee joint, and also the articular fibres of the hip and knee. The lateral cutaneous nerve of thigh confers cutaneous innervation to anteriolateral thigh which is also anaesthetized, and obturator nerve, which is primarily motor, supplies the medial adductors of the thigh, and innervates a portion of skin over the medial thigh.

Fascia Iliaca Compartment Block (FICB) has been widely used as a postoperative analgesic adjunct to opioids for lower limb surgeries, either by the conventional infrainguinal approach or the modified proximal suprainguinal approach. The modified FICB advised by Stevens[5] has more proximal spread of local anaesthetics, which is further confirmed in a cadaveric study. In their study, Kumar et al observed that in total hip arthrotomy (THA) modified suprainguinal FICB has significantly greater opioid sparing effect (i.e. requires less morphine consumption) as compared to the conventional infrainguinal FICB at 6, 12 and 24 hours for optimal analgesia in the postoperative period. The pain intensity as measured by VAS scores was significantly lower in suprainguinal FICB at 6 hours post- operatively as compared to infrainguinal FICB.[6]

Preliminary studies showed that nerve block with fascia iliaca compartment block (FICB) could significantly relieve the pain due to hip fracture in elderly patients who were expected to undergo surgery within 48 hours after hospital admission. Also, the FICB procedure led to improved quality of life during hospitalization but could not completely relieve the pain in some patients, resulting in a requirement for analgesic drugs for pain control.[7] Preoperative fascia iliaca compartment block significantly decreases postoperative opioid consumption while improving patient satisfaction.[8]

Studies so far have not compared different volumes of local anaesthetic (0.2% ropivacaine) in ultrasound guided suprainguinal fascia iliaca compartment block as part of multimodal analgesia after lower limb surgeries. In our study, we want to use different volumes of local anaesthetic, such as 20 ml, 30 ml, and 40 ml, to find out how much volume effectively spreads to the lumbar plexus to block the femoral nerve, the obturator nerve and the lateral femoral cutaneous nerve of thigh simultaneously, thus providing adequate analgesia for post-operative cases of lower limb surgeries.

6.2 REVIEW OF LITERATURE

The International Association for the Study of Pain's widely used definition defines pain as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage".[9] Painful stimuli are detected by nociceptors, which are free nerve endings located in tissues and organs. They have high thresholds and, under normal circumstances, only respond to noxious stimuli. The sensation of pain is associated with the activation of the receptors in the primary afferent fibers, which is inclusive of the unmyelinated C-fiber and myelinated Aσ-fiber. Both nociceptors remain silent during homeostasis in the absence of pain and are activated when there is a potential of noxious stimulus. The perception of a series of sensory events is required for the brain in order to detect pain and produce a response towards the threat. There are generally three main stages in the perception of pain. The first stage is pain sensitivity, followed by the second stage where the signals are transmitted from the periphery to the dorsal horn (DH), which is located in the spinal cord via the peripheral nervous system (PNS). Lastly, the third stage is to perform the transmission of the signals to the higher brain via the central nervous system (CNS). Typically, there are two routes for signal transmissions to be conducted: ascending and descending pathways. The pathway that goes upward carrying sensory information from the body via the spinal cord towards the brain is defined as the ascending pathway, whereas the nerves that goes downward from the brain to the reflex organs via the spinal cord is known as the descending pathway.

Pain can be classified into two types: chronic and acute pain. Acute inflammatory pain is normally intense and occurs for a short period of time, which is initiated as a response to harmful stimuli that are normally mediated by the Aδ-fibers. Leukocytes and plasma from the bloodstream are accumulated at the site of the injury to assist in the inflammatory process. However, prolonged inflammation, better known as chronic inflammatory pain, lasts beyond the expected period of healing, which is typically mediated by C-fibers. There is a progressive

shift of mononuclear cells at the site of the inflammation as well. Inflammatory pain causes the increase of afferent input into the DH of the spinal cord and leads to the development of central sensitization. There are some mediators produced at the site of injured tissue, which include 5-HT, kinins, histamine, nerve growth factors (NGF), adenosine triphosphate (ATP), PG, glutamate, leukotrienes, nitric oxide (NO), NE and protons. During the process of inflammation, these chemical inflammatory mediators are produced from the necrotic tissues, and interact to activate the nociceptors within the inflamed area.

Experience of pain has been reported as a common problem in clinical practice. Marks and Sachar[10] observed that 73% of medical in-patients had unrelieved pain of moderate to severe intensity despite treatment with opioids. Total hip replacements (THRs) are quite common these days and are quite successful surgery for many end-stage hip diseases in terms of pain relief and functional recovery.[11,12] However, THR are associated with severe perioperative pain which prolongs length of hospitalization and increases the morbidity and medical cost.[13,14] Though many guidelines reported that early surgery can relieve pain, and reduce the incidence of postoperative complications and mortality. Perioperative pain management is a big challenge for both patients and orthopaedician. Adequate pain management is crucial for improving the satisfaction of patients and clinical outcomes. Numerous strategies have been implemented to reduce postoperative pain following THR including local infiltration analgesia, epidural analgesia, intravenous non-steroidal anti-inflammatory agents and peripheral nerve block.[15-17]

The lumbar plexus is an essential collection of nerves that arise from mostly the lumbar spinal cord. The term plexus refers to a “web” of nerves that is created just lateral to where T12-L5 exit the spinal cord via intervertebral foramina. The plexus exists bilaterally and allows nerves to combine with different levels to create multiple functioning nerves that serve to innervate various structures. This type of nerve web is significant for the formation of larger, longer nerves that target peripheral tissues that altogether primarily help to innervate the

portions of lower extremities. The primary functions of these nerves are motor innervation and sensory nerves to the skin mainly in the lower extremities, although the superior nerves in the plexus do contribute to the lower abdomen and pelvis. The nerves arising from the lumbar plexus are vital for the functioning of the lower extremity and maintaining the ability to extend the knee, flex the hip, adduct the thigh, and more. The lateral femoral cutaneous nerve comes from the L2 and L3 spinal nerves. It serves the singular function of supplying sensory innervation to much of the lateral portion of the thigh.

The femoral nerve ranks as the largest nerve that arises from the lumbar plexus. It is created from lumbar spinal nerves L2, L3, and L4. Its principal function is to supply motor and sensory innervation to the anterior compartment of the thigh. The nerve exits the plexus and enters the femoral triangle, passing just lateral to the femoral artery. The nerve has four major branches: muscular (motor), cutaneous, articular, and vascular. The motor branch supplies the muscles quadriceps femoris, sartorius, and articularis genu. The cutaneous branch is the primary sensory supply to the anterior thigh. A portion of the cutaneous branch become the saphenous nerve, which provides sensation the skin overlying the patella, and portions of the medial and anterior aspects of the distal lower extremity. The articular branch plays an essential role in the proprioceptive sensation of the knee. The vascular branch supplies the femoral artery and its smaller branches.

The obturator nerve arises from L2, L3, and L4 spinal nerves. It provides the primary motor supply to the medial (adductor) muscle compartment of the thigh. These muscles include external obturator, adductor longus, adductor brevis, adductor magnus, gracilis, and pectineus. It also has a sensory component that supplies the medial thigh that is inferior to the area supplied by the ilioinguinal nerve.

The fascia iliaca compartment block has been promoted as a valuable regional anesthesia and analgesia technique for lower limb surgery. Numerous studies have been performed, but the evidence on the true benefits of the fascia iliaca compartment block is still limited. Recent

anatomical, radiological, and clinical research has demonstrated the limitations of the landmark infrainguinal technique. With the introduction of ultrasound, a new suprainguinal approach of the fascia iliaca has been described. Research has demonstrated that this technique leads to a more reliable block of the target nerves than the infrainguinal techniques.

The fascia iliaca compartment is a potential space lying between the fascia ilaca anteriorly and the iliacus and psoas muscles (iliopsoas) posteriorly. The fascia iliaca attaches to the iliac crest laterally and to the fascia overlying the psoas muscle medially. It lies posteriorly to the external iliac vessels and anteriorly to the nerves of the lumbar plexus. More distally, the fascia iliaca invests the FN and passes posterior to the femoral artery and vein which lie within the lacuna vasorum. The FN arises from the second to fourth lumbar nerve roots and descends through the fibres of psoas major before passing distally between the psoas and iliacus muscles. It then exits the pelvis to lie anterior to iliopsoas and lateral to the femoral vessels. The LCNT is a purely sensory nerve which arises from the second and third lumbar nerve roots and passes deep to the fascia iliaca before leaving the fascial plane around the level of the inguinal ligament. The ON arises from the second to fourth lumbar roots, is predominantly a motor nerve, and inconsistently innervates a proportion of the skin of the medial thigh. After penetrating the fascia and leaving the fascia iliaca compartment, the ON passes posterior to the common iliac artery before reaching the obturator foramen. All of these nerves lie within the fascia iliaca compartment at the proximal end of their anatomical course, and therefore placement of LA beneath the fascia iliaca should, in theory, result in anaesthesia of FN, ON, and LCNT. The genitofemoral nerve runs on the anterior aspect of the psoas muscle posterior to the fascia iliaca and therefore, the FICB may also result in anaesthesia of the genitofemoral nerve.

The ultrasound-guided (USG) longitudinal suprainguinal approach to the FICB was first described in a cadaver study by Hebbard in 2011.[18] The suprainguinal approach to the FICB has also been described using

a more proximal needle insertion point. A recent cadaveric study found that a volume of 40 ml was required to reliably block all three nerves using this approach.[19]

The USG longitudinal suprainguinal approach to the FICB theoretically improves block success rates as the LA is injected more cranially allowing more consistent block of the three targeted nerves (FN, LFCN, and ON). Success rates of ON blockade and blockade of all three nerves were 86% and 67%, respectively, in an RCT comparing USG suprainguinal FICB with placebo in patients undergoing total hip replacement (THR).[20] Indeed, a recent cadaver study demonstrated that the FN, LFCN, and ON could be reliably blocked using an USG suprainguinal FICB, but only if a volume of 40 ml was injected.[19]

A study done by Kumie et al used 30 ml of 0.25% bupivacaine in patients weighing less than 80 kg and 40 ml of the same in patients weighing more than 80 kg to check the efficacy of FICB as a part of multimodal analgesia after surgery of femoral bone fracture and concluded that a single injection of FICNB could lead to post operative pain relief, reduction of total analgesic consumption and prolonged time for first analgesic request in the FICNB group after surgery for femoral bone fracture.[21]

Another study done by Kumar et al used 30 ml of 0.5% ropivacaine by 23G spinal needle to study the analgesic efficacy of ultrasound guided FICB in patients with hip fracture, and concluded that ultrasound-guided FICB can be performed safely without complications in controlling pain for patients with hip fractures, and performing an FICB before positioning for spinal anaesthesia provided good pain management and facilitates spinal performance wit wide patient acceptance, hence improving overall quality and efficiency of care.[22]

A study done by Zhao et al used 20 ml of 0.375% ropivacaine to study USG guided suprainguinal FICB combined with a sacral plexus block for lower extremity surgery as suitable anaesthesia for patients with severe circulatory compromise.[23]

A study conducted by Kashyap et al on 60 subjects divided into two groups of 30 each, with group one being given FICB with 20 ml of 0.2%

ropivacaine 15 mins before subarachanoid block, and group 2 being given IV fentanyl at 1 mcg/kg single dose 15 mins before the subarachanoid block concluded that FICB provides positioning of the patient for spinal anaesthesia than IV fentanyl, and it prolongs the duration of first postoperative analgesia.[24]

Another study conducted by Sabra et al in which the subarachnoid block was given at the L3-4 interspace, and then the patients were divided into three groups according to the drug given in the suprainguinal fascia iliaca after subarachnoid block and before skin incision: group C received 40 ml normal saline, group R received 40 ml ropivacaine 0.2%, and group D received a mixture of dexmedetomidine 2 µg/kg diluted in 0.2% ropivacaine with 40 ml total volume. The primary outcome was evaluation of postoperative analgesia using numerical rating scale, recorded at 30 min and at 1, 3, 6, 9, 12, 15, 18, 21, and 24 h. Analgesic consumption and first analgesic request were the secondary outcomes. The numerical rating scale scores were significantly higher in group C when compared with groups R and D, at the 1, 3, and 6 h. Postoperative pethidine consumption during the first 24 h was found to be significantly less in group R and group D when compared with group C. There was a statistically significant difference in the group D when compared with group C and group R, with less number of patients who required rescue analgesic in 24 h and prolonged time for first request of rescue analgesic. The study concluded that the addition of dexmedetomidine to ropivacaine in FICB was efficacious in decreasing severity of pain, decreasing total analgesic consumption during the first 24 h, and prolonging the time for first request of analgesia in the postoperative period for patients undergoing hip arthroplasty.[25]

6.3 AIMS AND OBJECTIVES OF THE STUDY

To compare the efficacy of different volumes of ropivacaine in suprainguinal fascia iliaca compartment block for multimodal analgesia in lower limb surgeries.

Primary Objectives:

To evaluate:

- Time to first request of rescue analgesia

Secondary Objectives:

- Total requirement of analgesics for pain management in first 24 hours
- To evaluate the patient satisfaction score

7. MATERIALS AND METHODS

7.1 SOURCE OF DATA

A randomized, double blind study will be conducted in the Department of Anaesthesiology, Dayanand Medical College and Hospital, Ludhiana after approval by Institutional Ethics Committee on a total of 90 adult patients undergoing lower limb surgeries under subarachnoid block. These patients will be divided into 3 study groups of 30 patients each by computer generated randomization codes contained in sealed, sequentially numbered envelopes. A written informed consent will be obtained from each patient.

7.2 METHOD OF COLLECTION OF DATA

Inclusion Criteria:

- Patients scheduled for lower limb surgeries, including the hip and upto the knee joint
- ASA I, II and III patients
- Cognitive ability to comprehend NRS scale

Exclusion Criteria:

- Patient refusal
- Contraindications to the suprainguinal fascia iliaca compartment block (such as coagulopathies, infection at injection site, allergy to local anaesthetic)
- Patients on chronic opioid abuse
- Neuropathies

GROUP ALLOCATION:

A total of 90 patients will be recruited for the study and an equal number of patients will be allocated randomly using computer generated random number list to either of the 3 groups:

GROUP A: Comprises of 30 patients who will receive 20 ml of 0.2% ropivacaine in FICB.

GROUP B: Comprises of 30 patients who will receive 30 ml of 0.2% ropivacaine in FICB.

GROUP C: Comprises of 30 patients who will receive 40 ml of 0.2% ropivacaine in FICB.

The randomization scheme using computer generated random number will be prepared by our biostatistician and the patients as well as the observer involved in the study would be unaware of the group allocation. The allocation envelope will be opened by an anaesthesiologist who will be administering the block to the patient. This anaesthesiologist shall prepare the local anaesthetic solution as per random allocation sequence and perform the suprainguinal fascia iliaca compartment block. A blinded observer will assess preoperative and postoperative pain scores. These codes would be decoded at the end of study period.

PRE-ANAESTHETIC CHECK UP:

Routine thorough pre-anaesthetic check up will be conducted comprising of detailed history, comorbidities, allergy to any drug being used, general physical and systemic examination. Patients will be explained about the study being conducted and written informed consent will be taken and also educated on the use of NRS scale. Relevant investigations will be sent and reviewed.

Demographic information including BMI, age and sex, type of lower limb surgery will be recorded.

ANAESTHESIA TECHNIQUE:

On arrival in the operation theatre, patients will be positioned on the operating table in the supine position and routine monitoring in the form of 5-lead electrocardiography, non-invasive blood pressure (NIBP), temperature and pulse oximeter will be instituted. Heart rate (HR) will be recorded using 5 lead electrocardiography and non-invasive blood pressure (NIBP) using an automated non-invasive device that will be recycled every one minute until three consecutive measurements of systolic blood pressure (SBP) are recorded and mean of three readings will be recorded as baseline.

The patient will then be administered a subarachnoid block after proper positioning in the the sitting position, cleaning and draping, with 2.5 ml of 0.5% bupivacaine heavy and 0.5 ml (25 mcg) of fentanyl via a 26G quincke needle.

After successfully administering the subarachnoid block, the anaesthesiologist will stand on the side of the block. With the patient supine, a linear high frequency probe (6-14 MHz) will be placed in the sagittal plane to obtain an image of the ASIS. The probe will be moved medially and the fascia iliaca and sartorius, iliopsoas, and internal oblique muscles are identified. After identifying the 'bowtie sign' formed by the muscle fasciae, a 21-gauge, 100 cm stimuplex ultra 360 (B BRAUN) needle will be introduced 1 cm cephalad to the inguinal ligament. Using an in-plane approach, the needle tip will be positioned beneath the fascia iliaca, and hydro-dissection is used to separate the fascia iliaca from the iliacus muscle. The needle will then be further advanced in this space in a cranial and slightly dorsal direction. An injection will be considered successful if spread of LA is observed cranial to the point where the iliac muscle passes under the abdominal muscles. If adequate spread is not observed, the needle will be repositioned.[22]

A proper injection would be ensured by separation of fascia iliaca by the local anaesthetic in the medial-lateral direction.

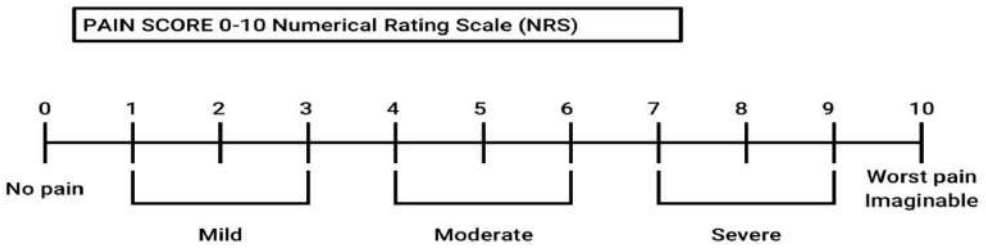
FOLLOWING OUTCOMES WILL BE OBSERVED POSTOPERATIVELY:

PRIMARY OUTCOME:

Is to evaluate the analgesic efficacy of varying volumes of local anaesthetic solution on pain management after suprainguinal fascia iliaca compartment block in postoperative period. This shall be evaluated using the following:

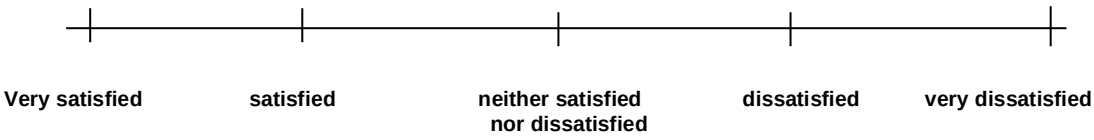
- Time to first request of analgesia- Duration of analgesia will be defined as the time taken from the initiation of block to the time to first requirement of rescue analgesia at NRS scale for pain ≥4.
- Numeric rating scale for pain will be recorded postoperatively, immediately on shifting to the PACU and then every hour for the first 4 hours and then 2 hourly for next 8 hours and then 4 hourly till 24 hours. The score will be determined by asking the patient to rate

the pain from 0-10, where in 0 being the least pain and 10 being the maximum.



SECONDARY OUTCOMES:

- Total requirement of analgesics in first 24 hours after surgery: this will include tramadol and fentanyl.
- Patient satisfaction with the pain management: Patient satisfaction score will be measured by asking the patient to rate their satisfaction on a 5-point Likert scale 24 hours after surgery.



- Injection tramadol 50 mg i/v will be used as rescue analgesic whenever the NRS **≥** 4, to a maximum of 150 mg within 24 hours following which if still NRS>4 then another rescue analgesic, injection Fentanyl 1mcg/kg IV as a slow bolus shall be administered
- Injection paracetamol (1 gm IV 6 hourly) will given to all patients as a part of the multimodal analgesia as a part of our study, in the first 24 hours after the surgery.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups will be done using Student t-test and Mann

Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test will be performed and Fischer exact test will be used when the expected frequency would be less than 5. A probability value (p value) less than 0.05 will be considered statistically significant. All statistical calculations will be done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

SAMPLE SIZE CALCULATION:

F tests - ANOVA: Fixed effects, omnibus, one-way

Analysis: Post hoc: Compute achieved power

Input: Effect size f = 0.3805187

α err prob = 0.05

Total sample size = 90

Number of groups = 3

Output: Noncentrality parameter λ = 13.031503

Critical F = 3.101296

Numerator df = 2

Denominator df = 87

Power (1-β err prob) = 0.898379

A post hoc power analysis was conducted using the software package, G*Power version 3.1.9.2 (Franz Faul, university kiel, Germany). The alpha level used for this analysis was $p<0.05$ and beta was 0.20. Sample size was estimated from the results of previous study[20,23,24] using the time to first request of analgesia as the parameter, which is the primary outcome of our study. Our sample size came out to be 30 subjects per group at power of 0.89 and with an effect size of 0.38 with 10% chance of error with α = 0.05, β = 0.20 and confidence interval of 95%.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

The study does not require any investigation or intervention other than those routinely done for every patient hip surgeries.

7.4 HAS ETHICAL CLEARENCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3 ?

Attached here with.

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PROFORMA

Serial Number:

Name:

MRD number:

Age/Sex:

Date of Surgery:

Type of surgery:

Duration of surgery:

DEMOGRAPHIC DATA

Weight:

Height:

BMI(kg/m^2):

ASA grade:

PRE-OPERATIVE VITALS:

CONSCIOUSNESS:

HR:

BP:

SpO_2:

RR:

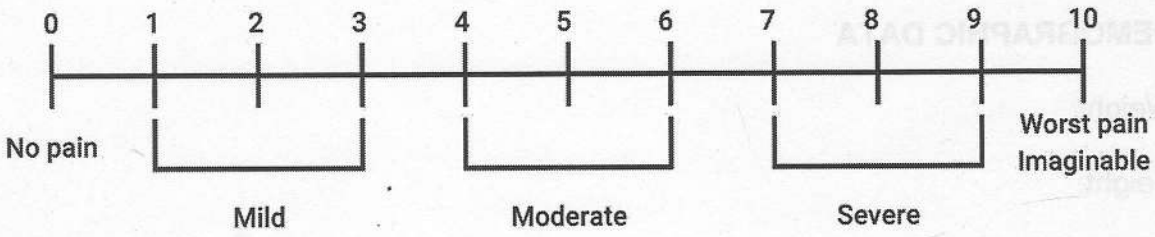
Signature of Candidate **Signature of Supervisor**

VITALS AND NRS SCORE

FOR FIRST 24 HOURS AFTER SURGERY:

	0 hr	1st hr	2nd hr	3rd hr	4th hr	6th hr	8th hr	10th hr	12th hr	15th hr	18th hr	24th hr
HR												
BP												
RR												
SpO_2												
NRS score												

PAIN SCORE 0-10 Numerical Rating Scale (NRS)



TIME TAKEN TO REQUEST OF FIRST ANAGLESIA: (TRAMADOL 50 mg IV)

_____ mins

TOTAL ANALGESIC CONSUMPTION IN FIRST 24 HOURS:

TRAMADOL:

FENTANYL:

ANALGESIC CONSUMPTION AT 3, 6, 12, 24 HOURS (CUMULATIVE DOSAGE) :

AT 3 HOURS:

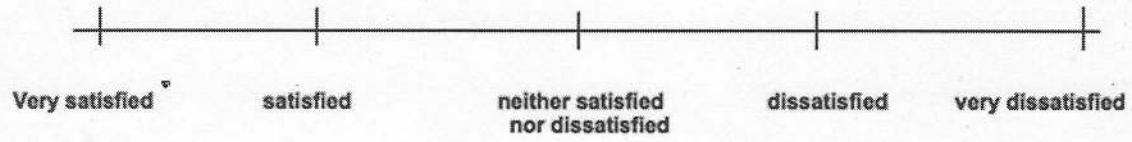
AT 6 HOURS:

AT 12 HOURS:

AT 24 HOURS:

Signature of Candidate **Signature of Supervisor**

PATIENT SATISFACTION WITH PAIN MANAGEMENT: (within 24 hours)



SIDE EFFECTS: (within 24 hours)

(Tick the ones observed)

NAUSEA	
VOMITING	
DROWSINESS	
URINARY RETENTION	
CONSTIPATION	
PRURITIS	
RESPIRATORY DEPRESSION	

OTHERS:_____

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o..... .....am willing to participate in the study **"EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERIES"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

....

Signature of the Witness Signature of the patient

Name:

Signature of Supervisor **Signature of Candidate**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____ निवासी _____ इस शोधकार्य **"EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERIES"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____ਵਾਸੀ

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"EFFICACY OF DIFFERENT VOLUMES OF 0.2% ROPIVACAINE IN SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR MULTIMODAL ANALGESIA IN LOWER LIMB SURGERIES" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ. ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

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ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

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ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

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ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ